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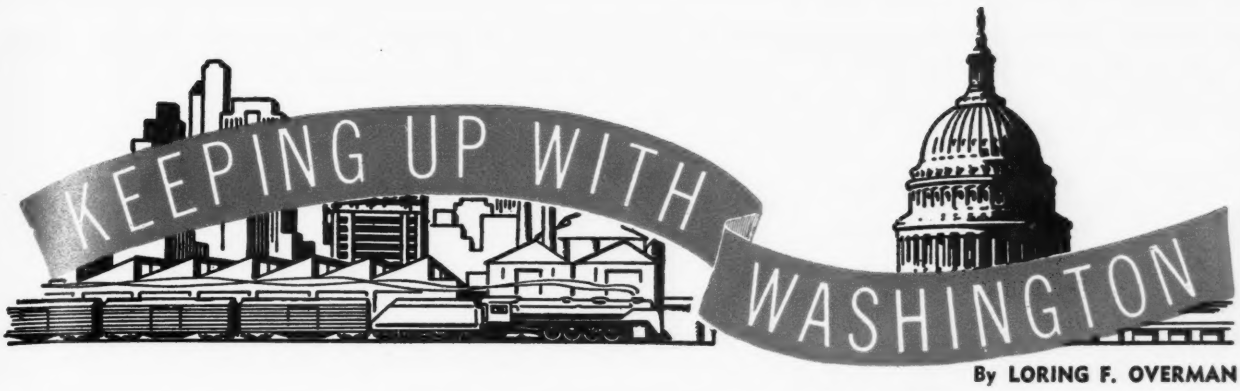
The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

MACHINE AND TOOL DESIGN

MANAGEMENT PROBLEMS AND CONVENTIONS

DEPARTMENTS



By LORING F. OVERMAN

Machine Tool Shortage a Top Defense Problem

THAT Congress, itself, may be asked to take a hand in trying to solve the problem of machine tool shortages was being discussed in Washington shortly following adjournment. The suggestion, coming from members of the Munitions Board, was that Congress consider making provisions for the stockpiling of general-purpose machine tools, as well as those used in the manufacture of standard equipment. Stockpiling, it was pointed out, would avert repetition of the current shortage, and would eliminate some of the ups and downs of the industry's demand curve. It might also speed the expansion of current output by assuring manufacturers of a reasonable volume in the event of a worldwide "cease fire."

Meanwhile, a DPA-NPA study reveals that the machine tool shortage is one of the year's top mobilization problems. Although production rates are rising rapidly, there is a twenty-two months' backlog of orders, and little likelihood that the squeeze will be relieved in 1952. Present production capacity is reported as below the levels existing when the United States entered World War II. At that time, the machine tool industry had been expanding for two years to fill orders for countries then at war with Germany. Thus, Korea caught the industry with its capacity down; and management was reluctant to expand in view of past experiences and an unknown future demand.

EVEN now the demand question is an enigma. Backlog of orders is estimated at more than $1,300,000,000, with present production at the annual rate of $650,000,000. Still to be placed, however, are orders about double the value of those outstanding. What types of machines will be needed will not be known until some of the new defense items come from drawing boards and testing laboratories into the production stage. That stage is reportedly nearing for guided missiles, new type jets, and other military items still on the restricted list. Unfortunately, the machine tools that will be wanted overnight to produce these new items cannot be ordered until the last bug has been ironed out and until a contractor has been selected to go ahead with production.

ANOTHER factor making it difficult to forecast future machine tool needs is that it is not unusual for two or three contractors who build the same item to use different production methods and machine tools. As one of half a dozen Government agencies working on the problem, the Munitions Board is compiling a list of anticipated machine tool needs, as seen from the vantage point of its advance knowledge of military programs. Such a list should result in a more efficient operation of the General Services Administration's "pool order" contract program.

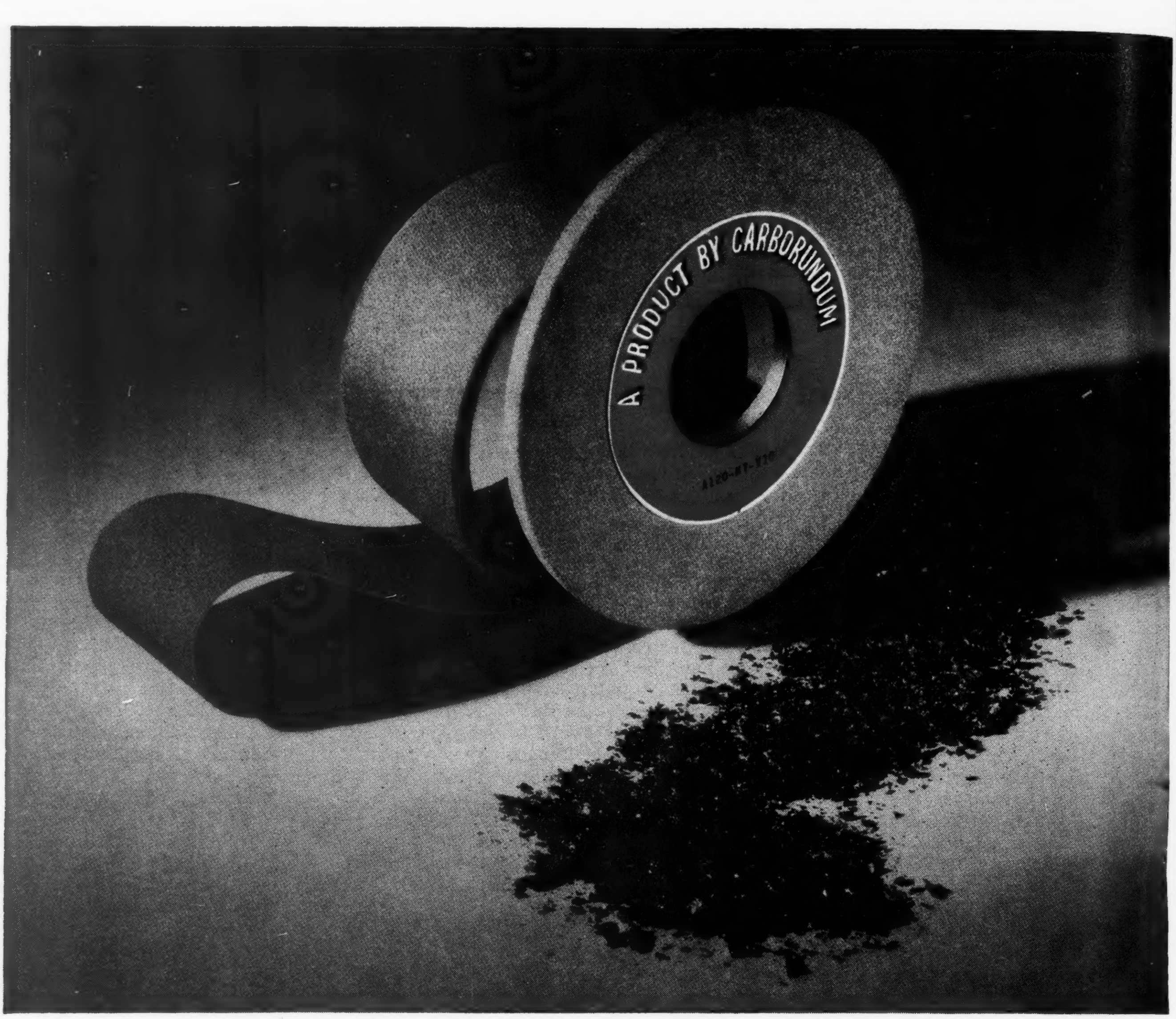
DIRECTING the many and varied efforts to ease the situation is Swan Bergstrom, who replaces Harold Tigges as director of the Metal-Working Equipment Division of the National Production Authority. Mr. Bergstrom is on leave as vice-president and director of the Cincinnati Milling Machine Co. of Ohio. Mr. Tigges has returned to his post as vice-president of Baker Brothers, Toledo. Among other procedures, Mr. Bergstrom is recruiting production capacity for machine tool manufacture from makers of machinery used in such industries as graphic arts, canning, textiles, packaging, and pulp and paper. A special sub-contracting unit has been set up under Mr. Bergstrom to advise heavy goods manufacturers of the needs of machine tool builders. In turn, this unit informs machine tool people of the available sub-contracting capacity.

THE Air Force on October 29 renewed its invitation to contractors and sub-contractors to inspect the 5,000 machines warehoused in storage depots at Marietta, Ga., and Omaha, Neb., and select what they needed. During September, 4635 machines were selected. Those remaining—principally gear machines, grinding machines, and welding equipment—are valued at approximately $80,000,000. A list of available items may be obtained from Production Equipment Joint Central Inventory Group, Old Post Office Bldg., Washington, D. C.

CONSIDERED imminent at press time was an order that will bar machine tool producers, including the so-called "captive" tool shops, from accepting machine tool orders that are not intended for use on military contracts or in basic defense-supporting programs. In connection with the order, Manly Fleischmann, Defense Production Administrator, has stated that no new manufacturing for the civilian economy requiring retooling will be permitted until machine tool producers catch up. His statement was understood to mean that new models of autos and other civilian goods that are in the works for 1952 will be allowed, but that in 1953 there will be no new designs in autos or other consumer hard goods.

IN announcing termination of the sixty-day moratorium on the issuance of tax amortization certificates to encourage expansion of facilities for production of defense items, ODM Director Charles E. Wilson again put machine tool needs out in front. The official announcement says, "In the initial stages, priority of treatment will be given applications involving production of the following facilities" in the order indicated: (1) Machine tools, cutting tools, dies, gages, jigs and fixtures; (2) ores such as copper, lead, and zinc; (3) pig iron; (4) sulphur; (5) military end items and supporting products urgently needed by Armed Services; (6) basic aluminum; (7) nitrogen; (8) aviation gasoline; (9) steel scrap; and (10) special aluminum extrusions.

One more move "for the good of the order" was in the works at press time. The Wage Stabilization Board was considering the recommendations of a special panel appointed to propose some means of equalizing pay within the machine tool industry and of protecting producers against pirating of manpower. The Bureau of Labor estimates that the industry will need about 50 per cent more workers and a longer work week to carry the load assigned it.



Often it takes all three...

A typical example of the many products which call for the use of not one...two...but *all three* types of abrasives in the manufacturing process are shears. Thus at three different stages it is important to be able to count on the performance of a coated abrasive, a bonded abrasive, or abrasive grain in obtaining best results.

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Influence of Standardization on Production

BACK in the days before industry commenced to standardize the products made by myriads of concerns, a housewife could not buy electric light bulbs with the assurance that they would fit any lamp socket in her home or purchase a mattress with the confidence that it would fit a particular bedstead. A mechanic could not buy a machine screw or other threaded fastening device with the definite knowledge that it could be screwed into holes tapped in some appliance. He could not buy tools and feel certain that they would be applicable to his machines. Examples of confusion in the shop and in the home resulting from lack of standardization could be cited endlessly.

Some manufacturers deliberately made their products with a view to forcing users to make replacement purchases from them and causing difficulties if competitors attempted duplication. Inconvenience to customers with ensuing irritation was the inevitable result.

These facts were pointed out by Herbert Hoover on a recent occasion when he was honored with the Howard Coonley Medal of the American Standards Association for the impetus he gave to standardization when he became Secretary of Commerce. Since that day—thirty years ago—the tremendous strides made in the standardization and simplification of many parts and elements have eliminated innumerable instances of inconvenience, but there is a "by product" of standardization that is not often thought about which has proved to be of immeasurable benefit to industry. This so-called "by product" is increased production. While the general public often assumes that greater production has come from scientific discovery of natural laws, new materials, inventions, and increased skills, there is no doubt about the fact that the standardization and simplification of industrial products have fostered mass production.

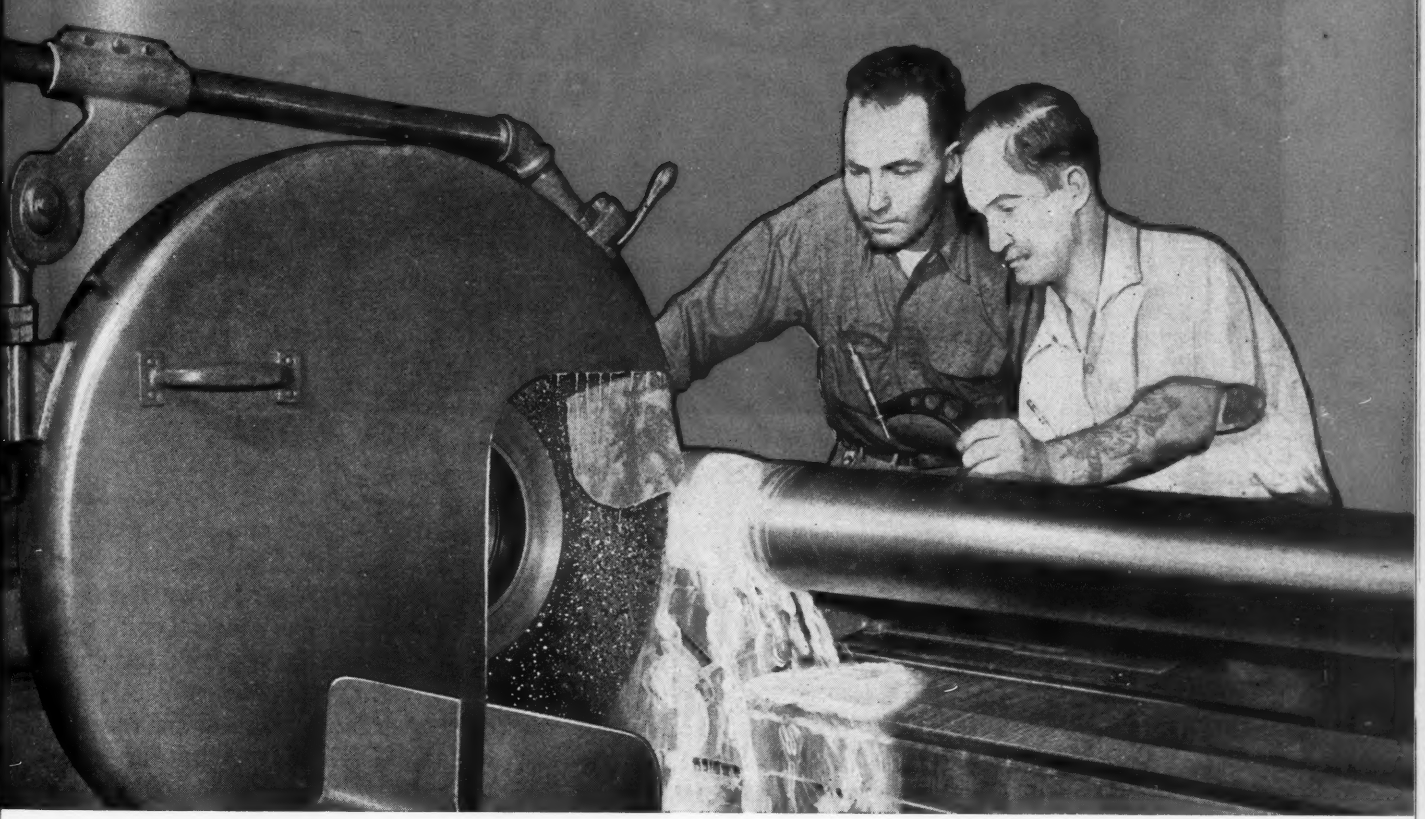
Standardization has made possible more continuous employment by enabling products to be manufactured for stock instead of depending upon special orders. It has made it possible to conduct our great productive machine with the least amount of spare parts and inventories in the hands of the consumer industries. As Mr. Hoover pointed out, standardization and simplification have reduced the cost of production in many directions, and have enabled thousands of articles to be placed within the reach of everybody.

Only a few of the literally thousands of standardizations and simplifications have been imposed by law. They have been the result of voluntary, yet organized, cooperation within industry. Tremendous credit is due to the American Standards Association and to various engineering societies, trade organizations, and individual industrial concerns for their contribution to the important advances made in the work of standardizing and simplifying manufactured products.

Charles O. Herb
EDITOR

GUNS FOR OUR LATEST LIGHT TANK

By GEORGE H. DeGROAT



Semi-Automatic, Gyroscopically Controlled 76-Millimeter Guns are Now in Production for Use on the New 26-Ton "Walker Bulldog" Tanks. In Making These Weapons, Special Artillery Manufacturing Equipment is Used, as Well as Standard Machine Tools. Some of These Operations and the Machines Employed are Described Here

ONE of the latest developments in connection with the current defense effort is the 76-millimeter gun now being produced by American Type Founders, Inc., Elizabeth, N. J., to arm the new 26-ton "Walker Bulldog" tank. This semi-automatic weapon is gyroscopically controlled, so that it will stay on a target even when the tank is traveling over rough terrain. It has an unusually short recoil of only 9 inches. A muzzle brake deflects gas pressures backward to counteract recoil and prevent the raising of large clouds of dust, which ordinarily obscure the gunner's vision.

The new gun consists principally of a finished tube with muzzle brake and a breech mechanism, the total over-all length being 16 feet. Extreme care is exercised in machining each component, and numerous floor inspections are made prior to final inspection, in order to insure the highest possible quality in the finished weapon.

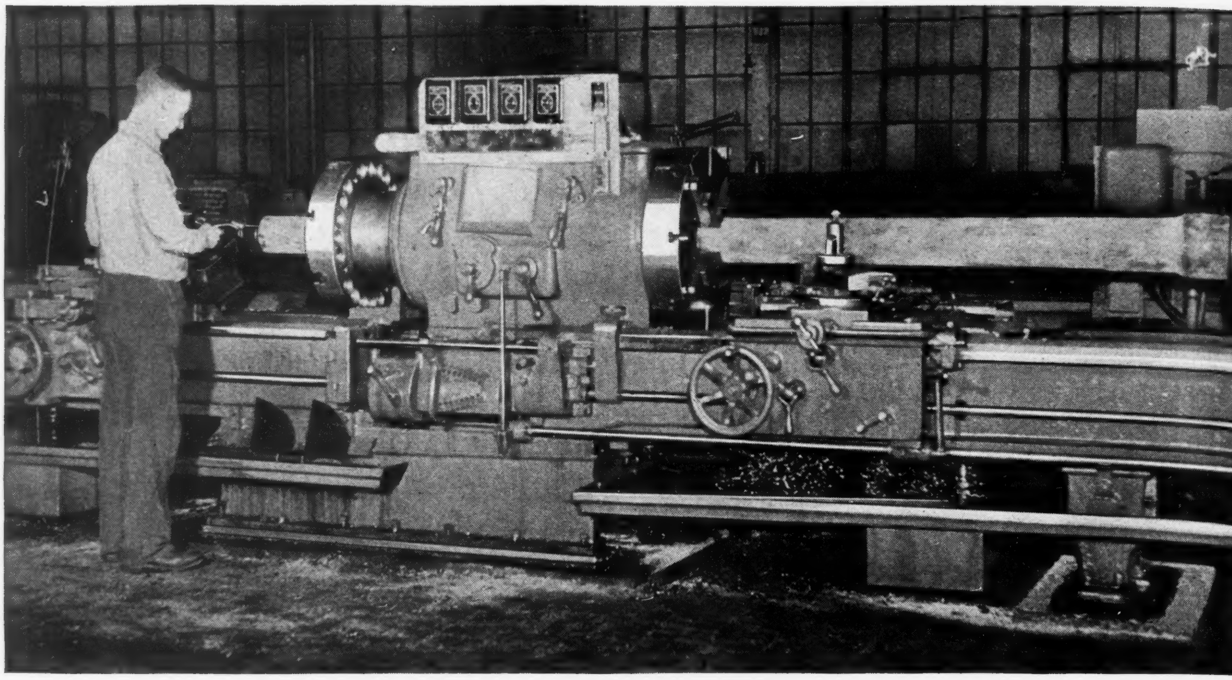


Fig. 1. A high-strength alloy-steel forging is rough-turned in one of the initial machining operations performed on gun tubes

The gun tube is a high-strength alloy steel forging. After checking these forgings for size and stock distribution, and then straightening them if necessary, the first machining operations are performed.

As shown in Fig. 1, the first light cuts are made in a Lehmann lathe, where the bore at the muzzle end of the tube is chamfered to an angle of 60 degrees by 2 3/4 inches in diameter to accommodate a revolving bull center in subsequent operations. Also, forging scale is removed from the periphery for a length of approximately 15 inches at the muzzle end. This end is then chucked to run concentrically within 0.002 inch total indicator reading, and the breech end of the tube is turned to remove forging scale for about the same distance as at the other end. A roller rest is employed at this section during the subsequent operation, in which the breech end is faced and the bore provided with a 60-degree chamfer, 2 3/4 inches in diameter. This is followed by turning a section to accommodate a steadyrest, and then turning the periphery of the tube for a length of approximately 107 inches

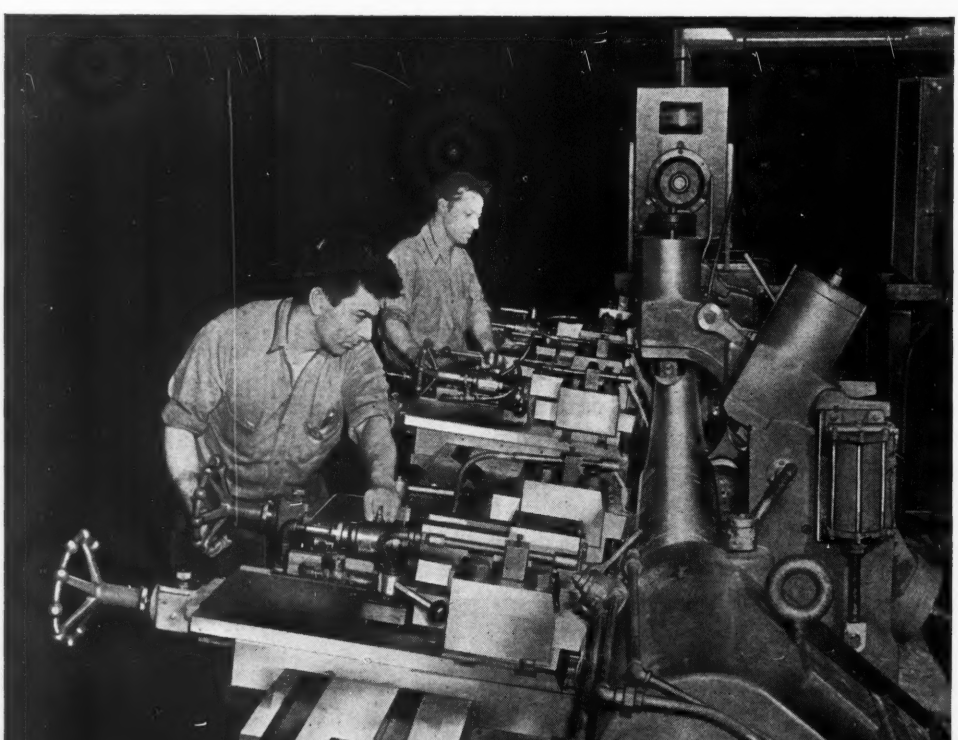


Fig. 2. A "Lo-Swing" lathe with several machining stations is used in rough-turning the gun tubes

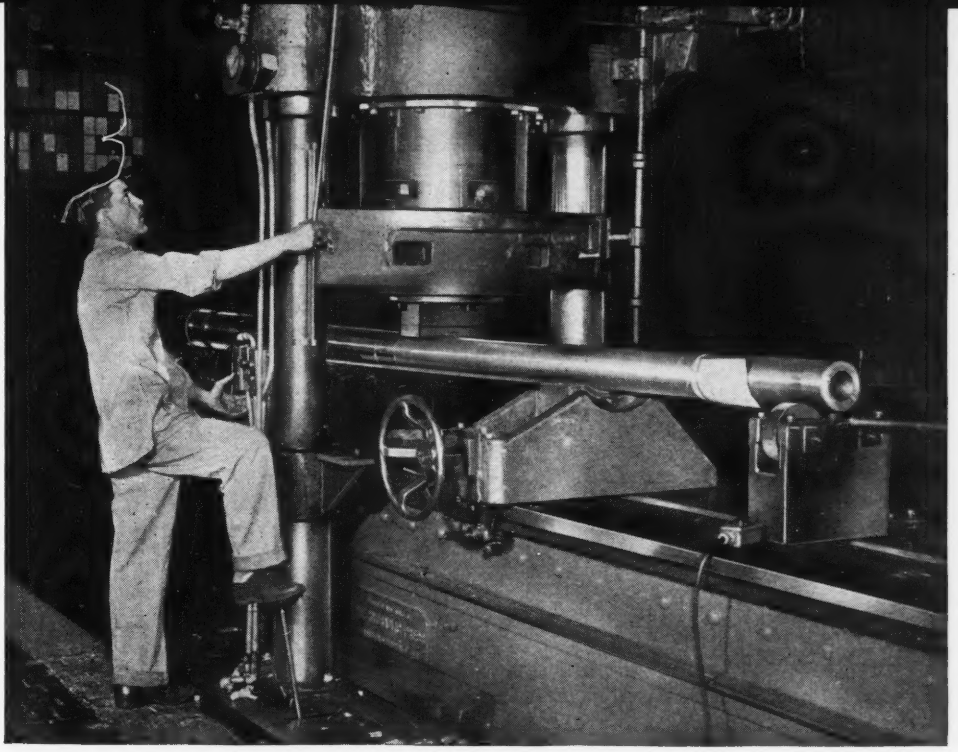


Fig. 3. Straightening gun tubes before and after boring operations is important in maintaining a high degree of concentricity

from the face of the breech end. The Seneca Falls "Lo-Swing" lathe illustrated in Fig. 2 is also employed for some of the initial turning operations on the gun tubes.

Upon the completion of these operations, the main bore is rough-machined to 2.625 inches in diameter for half the length of the tube from the muzzle end, after which the operation is repeated from the breech end. This work is performed with carbide tools in a W. F. & John Barnes two-spindle horizontal boring machine.

Following the rough-boring, the tubes are checked for straightness by running the arms of a "tell-tale" dial indicator gage through the bore at each end, after which they are straightened to whatever degree is necessary. Fig. 3 shows a 500-ton H-P-M press being employed for straightening a tube.

Next, the tubes are bored to 2.750 inches diameter for the full length in a W. F. & John Barnes single-spindle machine. In this operation, the work must run true within 0.002 inch total indicator reading. The tubes are now turned again for short distances at each end, rechecked for eccentricity, and straightened if necessary.

This is followed by further lathe operations.

Fig. 4. Reaming gun tubes to close tolerances requires special care and rigid set-ups such as shown in this illustration

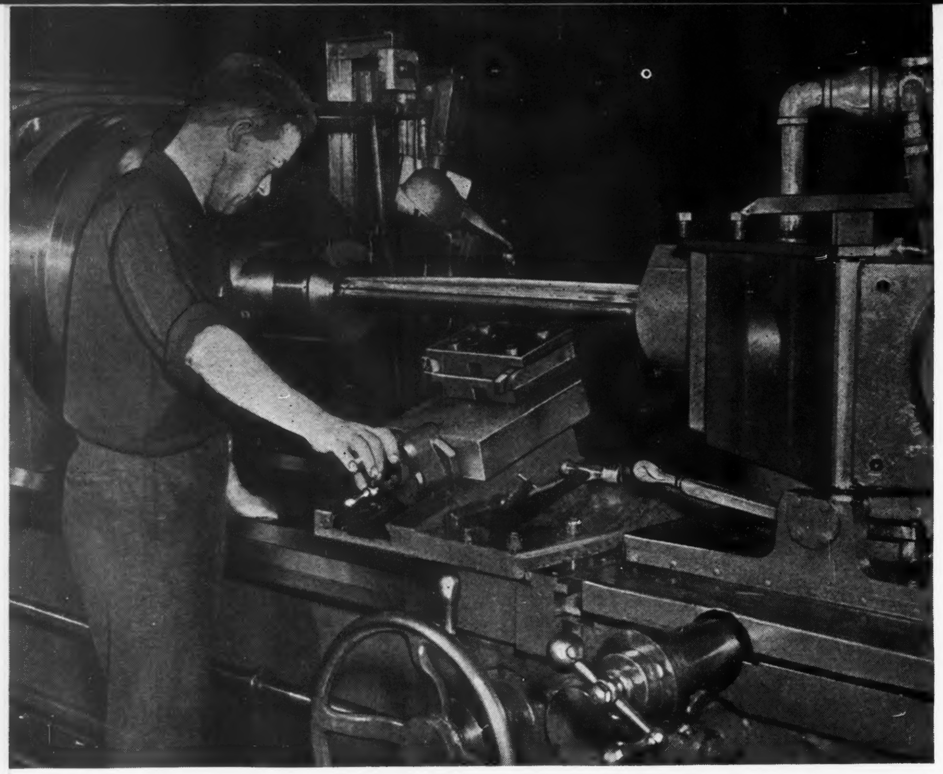


Fig. 5. In this turret lathe set-up, the breech end of the tube is faced and then bored concentric within 0.002 inch total indicator reading

First, the breech end is turned for about 52 inches from the chuck in which it is held; then, with the muzzle end held in the chuck and the breech end supported in a revolving bull center, the muzzle end is turned for approximately 21 inches. A taper is then produced about 52 inches from the breech end and 20 inches from the muzzle end, blending into a 20-inch radius at both ends. After spot-turning the breech and muzzle ends and taking a light clean-up cut at the center of the tubes for a steadyrest, both ends are bored to 2.875 inches in diameter in the two-spindle machine previously mentioned.

Subsequent operations include reaming the tube bores to 2.960 inches in diameter in a LeBlond machine, Fig. 4; turning the breech and muzzle ends; and semi-finish-honing the bores to 2.990 inches diameter, plus or minus 0.002 inch. Horizontal, hydraulically reciprocated honing machines built by the Barnes Drill Co. are employed for the last-mentioned operation. The tubes are then inspected, turned at the breech and muzzle ends to blend with the taper, and straightened if this is required.

One of several turret lathe operations is illustrated in Fig. 5. Here the breech end of the tube is held in the chuck of a Lehmann turret lathe, while the remainder of the tube extends through the headstock to supports at the left of the machine. The bore is checked for concentricity within 0.002 inch total indicator reading, after which the breech face is finish-machined and the powder chamber rough- and semi-finish-bored in the breech end of the bore. About 0.030 to

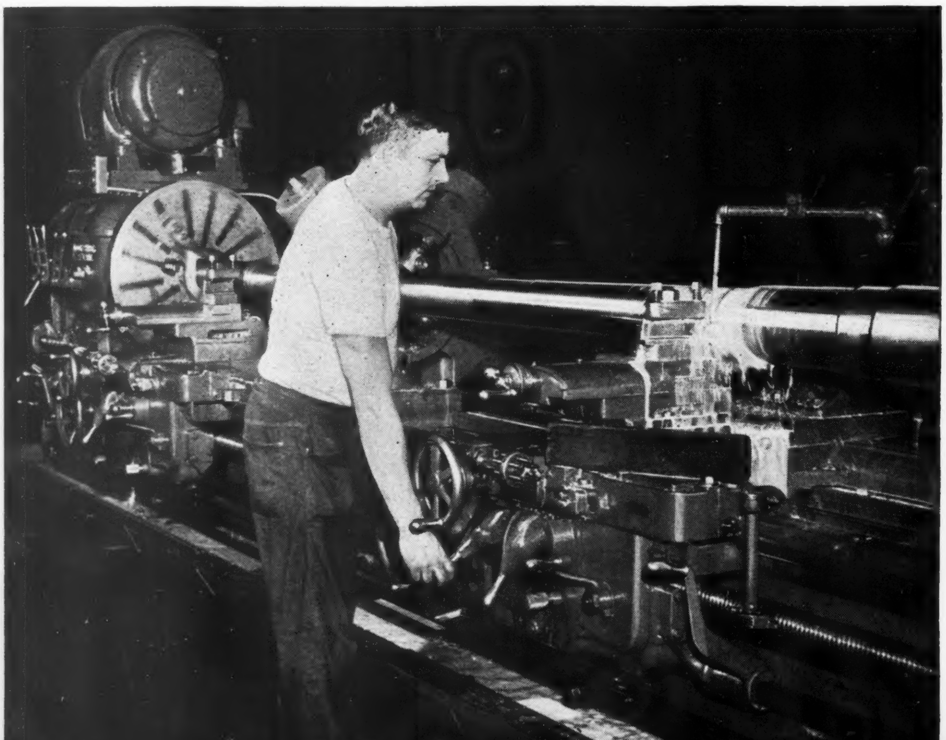


Fig. 6. Several turning operations are performed on various sections along the length of a gun tube in a single set-up

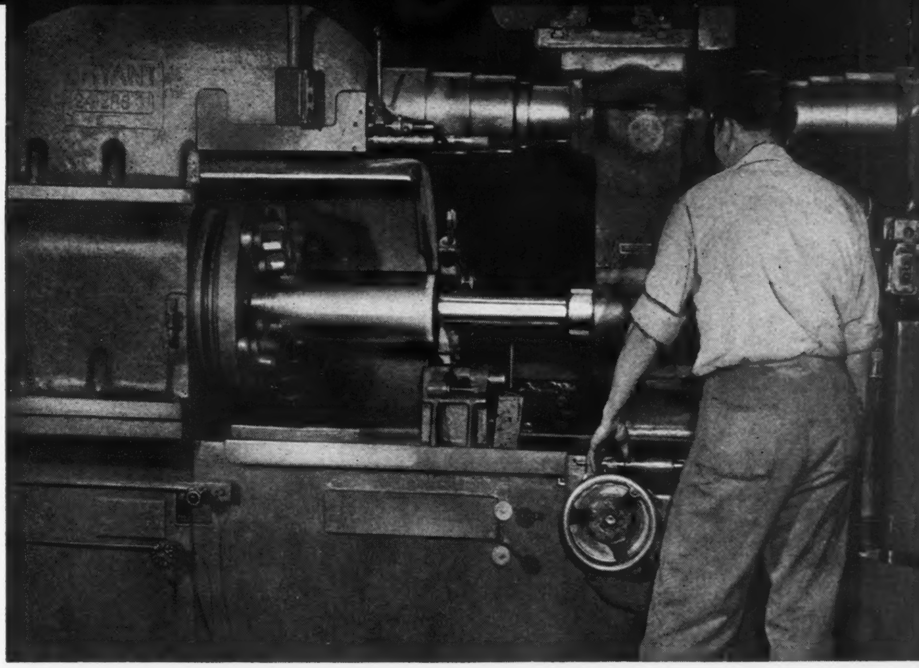


Fig. 7. The powder chamber at the breech end of a gun tube is ground to close tolerances by the use of the equipment shown in this illustration

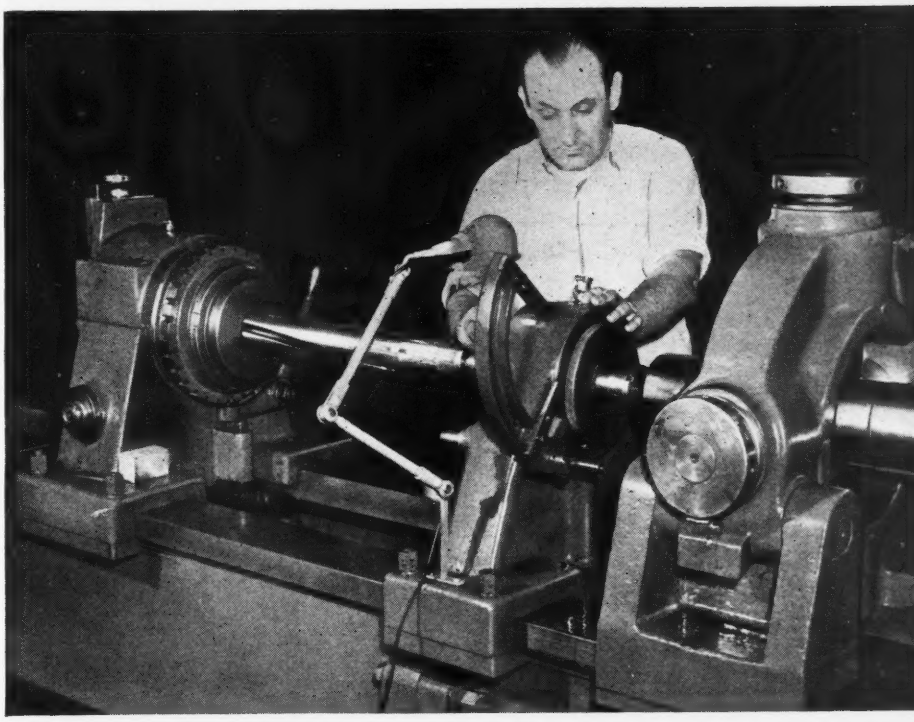


Fig. 8. Rifling of the gun tubes is accomplished by means of broach segments mounted on a tool-bar that rotates in a uniform right-hand spiral as it moves forward through the tube

Fig. 9. One of the milling operations required in machining a breech-block for the 76-millimeter tank gun

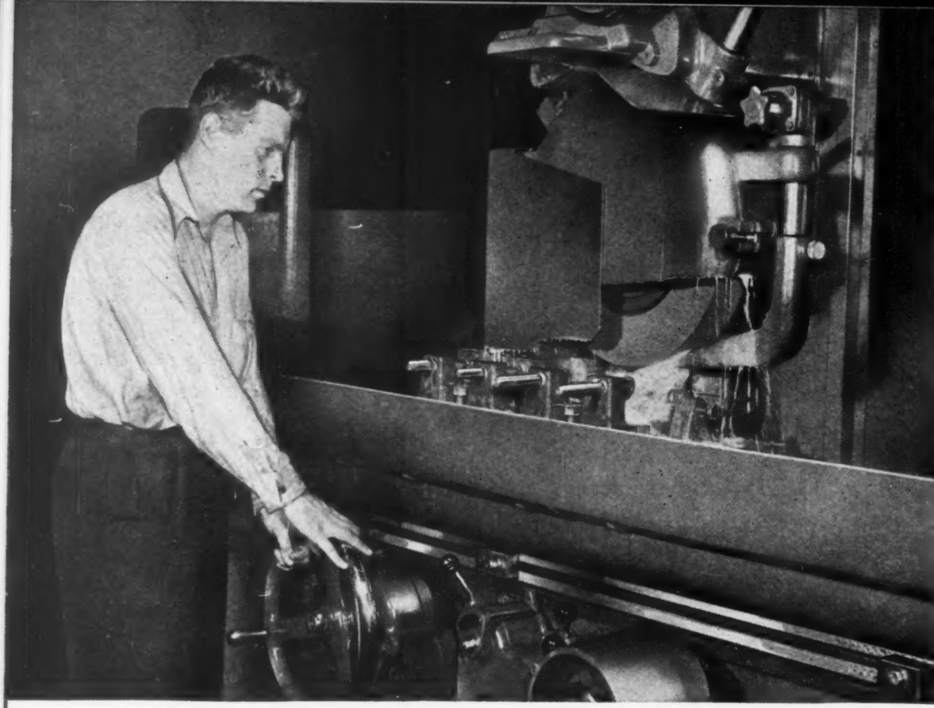


Fig. 10. Breech-blocks require surface grinding operations to tolerances as close as plus or minus 0.0005 inch

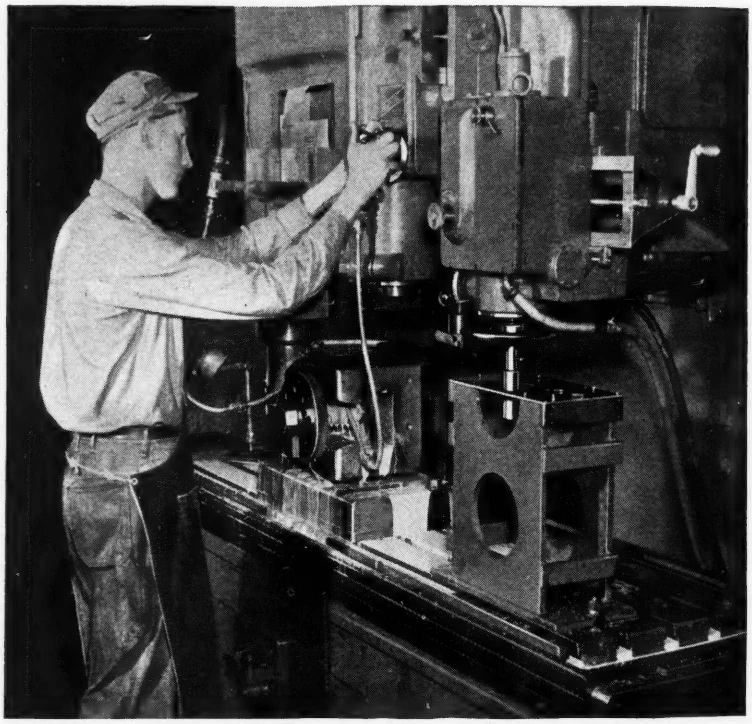


Fig. 11. Set-up for contour-milling the internal profiles in breech-rings

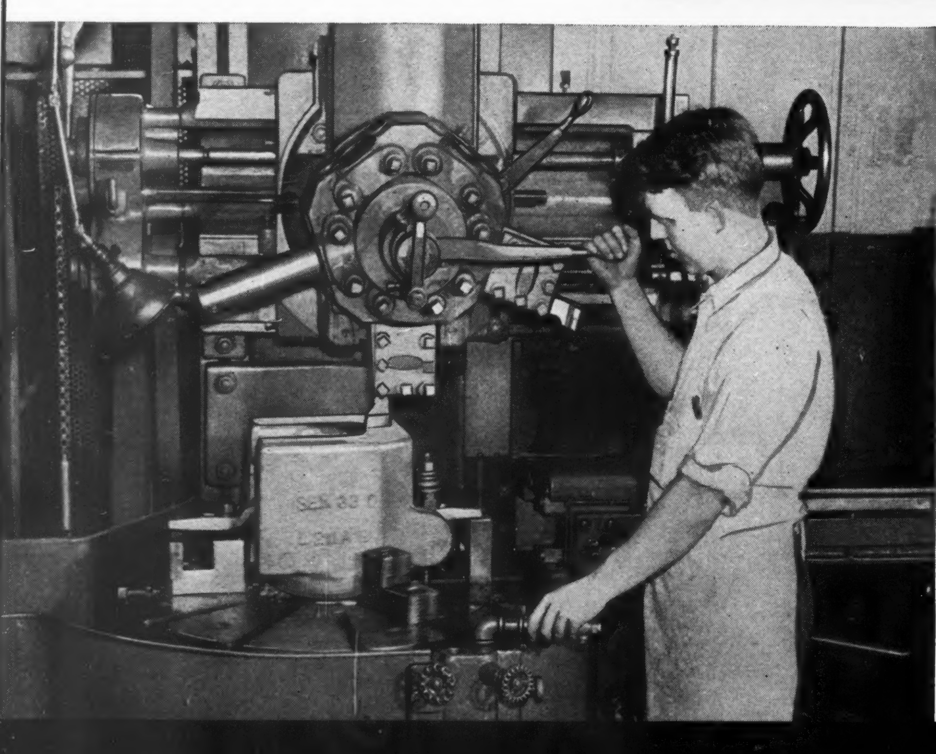


Fig. 12. A vertical turret lathe is used to produce locating surfaces on a breech-ring forging

Fig. 13. Accurate openings are produced in breech-rings on a broaching machine equipped with pull broaches

0.035 inch of stock is left for grinding in this operation, which is followed by turning various parts of the tube periphery.

After the turning operations, one of which is seen in Fig. 6 being performed in a 27-inch Lodge & Shipley lathe, the bores are finish-honed to 3.000 inches in diameter within a tolerance of plus 0.002 inch on the Barnes honing machine mentioned previously. This is followed by grinding the powder chamber in a Bryant chucking grinder, Fig. 7. Among the external grinding operations on the tubes is the one shown being performed on a Norton grinder in the heading illustration, where sections of the tube periphery are rough-ground.

Rifling of the gun tubes is one of the most interesting operations performed in the plant. This work is done in LeBlond horizontal gun rifling machines, using thirty-two disc-shaped high-speed steel broaches, one of which is mounted at the end of a long tool-bar for each pass. The tool-bar rotates slowly as it enters the tube, turning in a uniform right-hand spiral as it moves forward. This movement is the result of the engagement of a key in an indexing head, Fig. 8, with a spiral groove in the tool-bar. Coolant is supplied to the cutting tools through the hollow tool-bar.

After cutting off the surplus stock left on the tube to provide for facing to the proper length, the muzzle ends are faced, the rifling groove is beveled, and an angle is formed. This is followed by deburring the muzzle ends. Several finish-turning and grinding operations are then performed, after which threads are milled on both the breech and muzzle ends in a Smalley General thread-milling machine. Among the final operations on each tube are finish-milling a keyway, finish-milling extractor pockets in the breech face, milling a slot at the muzzle end, and deburring. Inspection completes the procedure.

Machining Operations on the Breech-Block and Breech-Ring

One of the first machining operations on the breech-block forging is rough-milling. This is done on the Fitchburg horizontal, duplex milling machine shown in Fig. 9. Then follows a series of semi-finish-milling operations on various surfaces. After drilling firing mechanism holes, 3/4 inch in diameter by 3 inches deep, the breech-blocks are heat-treated and drawn to a hardness of 30 to 35 Rockwell C.

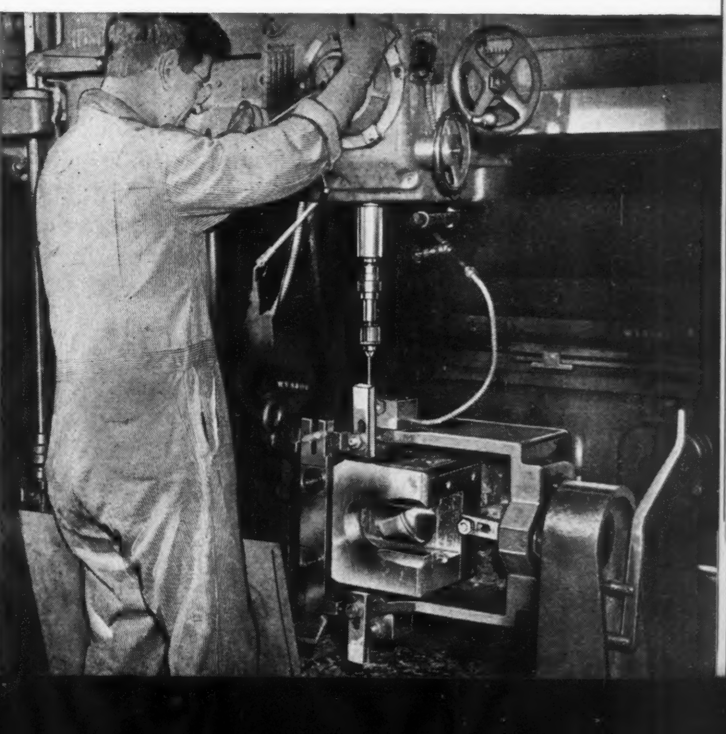


Fig. 14. A radial drilling machine is employed in producing some of the many holes required in breech-rings

Typical of the grinding operations performed on the breech-blocks is the one shown in Fig. 10. Here the work is being finish-ground to within plus or minus 0.0005 inch on a Mattison surface grinder. Other operations consist of drilling, boring, reaming, forming radii, and facing shoulders in Warner & Swasey turret lathes; drilling and reaming firing pin holes on six-spindle Allen drill presses; and finish-milling. An elongated hole, 0.500 inch wide, intersecting the firing pin hole, is produced on a Pratt & Whitney single-spindle profiling machine.

After further milling and profiling, the breech-blocks are broached. For example, an opening 1.250 inches wide by 1.870 inches deep is machined in the bottom of a breech-block with a pull broach in a Lapointe horizontal broaching machine. Another broaching operation is the production of a T-slot at an angle of 34 degrees plus or minus 15 minutes. After the final operations, which include further milling, drilling, reaming, and grinding, the breech-blocks are nitrided to a case depth of 0.020 inch. A final protective finish is then applied.

An interesting operation on the breech-rings is the contour milling of internal profiles. This is done on a Cincinnati Hydro-Tel, as may be seen in Fig. 11. Prior to this, several rough- and semi-finish-machining operations are performed. One of these is illustrated in Fig. 12, where the first locating surface is being produced on a Bullard vertical turret lathe, using two carbide tool bits. About 0.150 to 0.200 inch of stock is removed in rough- and finish-facing.

After broaching an opening 5.500 inch wide in the ring, together with a keyway 1.630 inch wide, having an angle of 1 degree 15 minutes, each ring is milled, bored, and ground. This is followed by another broaching operation, as shown in Fig. 13, performed on a Lapointe machine. The rings are then finish-bored, ground, formed, milled, drilled, and reamed. One of the drilling operations, accomplished on a Carlton radial drilling machine, is illustrated in Fig. 14.

The final operations include rough- and finish-milling of threads, burring, and coating with phosphate. All longitudinal scratches in the fillets of breech-ring recesses are removed, and then this part—like the others—undergoes a thorough final inspection before assembly.

Plastic Deformation of Chromium-Plated Steel for Aircraft Studied

The advantages of chromium plating are sometimes offset by a reduction in the ability of the base metal to deform plastically without breaking. To learn more about the effect of chromium plating on the plastic deformation of steels used in aircraft, the National Bureau of Standards has made a comprehensive study of the mechanical properties of chromium-plated SAE 4130 steel.

The investigation included tensile, tensile impact, bending, and crushing tests of specimens prepared from rod and tubing of the steel heat-treated to a hardness of about 40 Rockwell C before final machining. Some of the specimens were tested as machined, without plating; others were tested after plating to one or more thicknesses; and still others after both plating and subsequent baking at various temperatures up to 440 degrees C.

In all except the tensile impact tests, the data obtained indicated that chromium plating appreciably reduces the plastic deformation that can occur in SAE 4130 steel before fracture. Generally, however, the ability of the plated specimens to undergo plastic deformation was substantially increased by baking at temperatures of between 100 and 440 degrees C. It is possible that hydrogen deposited with the chromium during plating may be a factor in reducing the amount of plastic deformation that the steel can withstand. In that case, baking of plated specimens, by removing hydrogen from the chromium, would increase their ability to undergo deformation.

* * *

Machine Tool Catalogue Service

The machine tool industry is to have a new specialized catalogue service through which machine tool builders can obtain any or all of the following services: (1) Catalogue design, (2) catalogue printing and (3) catalogue distribution. These facilities are available through Sweet's Catalog Service, 119 W. 40th St., New York 18, N. Y. Manufacturers may order their catalogues delivered to prospective buyers either in individually bound form or "pre-filed" in a bound, indexed file.

Fast Machining Set-Ups for Cast-Aluminum Bases

Milling, Drilling, and Boring of All Six Sides of Cast-Aluminum Machine Bases are Rapidly Accomplished, with Minimum Handling, by the Use of the Efficient Set-Ups Here Described. Trunnion Work-Holding Fixtures are a Feature of the Tooling

By HERBERT CHASE

MACHINES for punching holes in cards used in accounting machines are among those built by the International Business Machines Corporation at its Poughkeepsie, N. Y., plant. The bases for such machines are aluminum-magnesium permanent-mold castings, approximately 6 inches square in cross-section and about 30 inches long. New set-ups devised for machining these castings constitute excellent examples of economical tooling.

Owing in part to good design of the casting (especially from a machining standpoint), all bosses on the four long sides are faced in two passes through two milling set-ups, and the end bosses are similarly faced in one pass through a third straddle milling operation. Holes are then drilled from all four sides of the casting, and many of the holes are reamed by a row of multiple-spindle machines connected by a track along which a box type trunnion fixture holding the casting is moved. Finish-boring of certain holes in three multiple-spindle double-end boring machines substantially finishes the machining operations required on the casting.

For the initial operation, the casting is held in a fixture on the table of a Cincinnati duplex milling machine, Fig. 1, and two of the long sides are straddle-milled in one pass. Carbide-tipped, inserted-blade cutters, 6 inches in diameter, are employed, and about twenty castings an hour are faced. Approximately 1/8 inch of metal is removed from each side of the casting

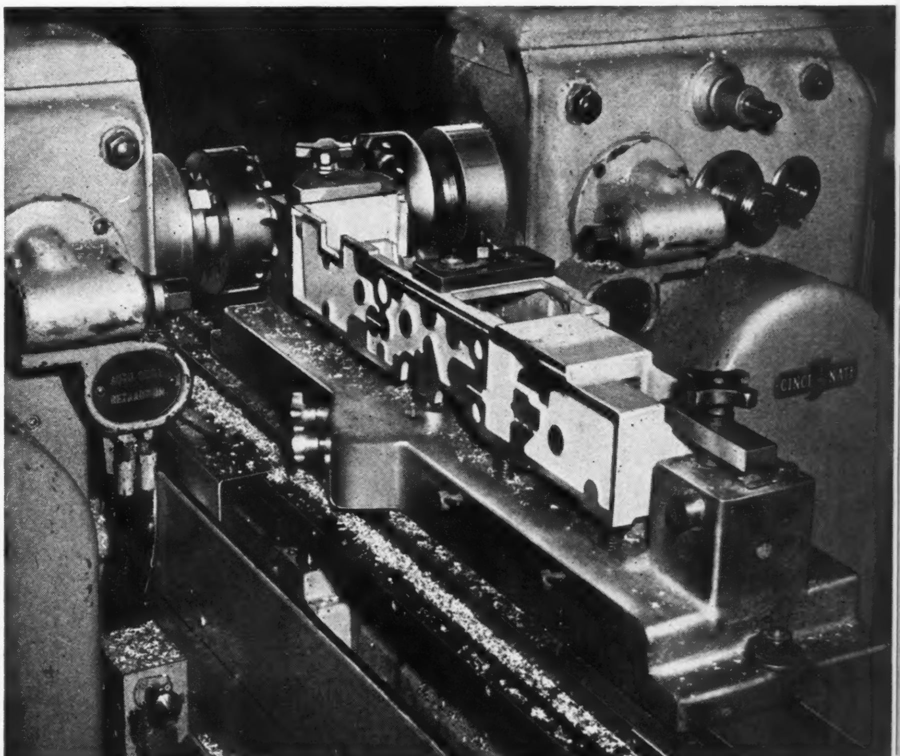


Fig. 1. In this straddle milling set-up — the first of three such operations — bosses on two of the long sides of the cast-aluminum machine base are finish-machined. The same machine, equipped with another fixture, mills the other two long faces of the casting. In a third set-up on another machine, bosses on the ends of the casting are straddle-milled

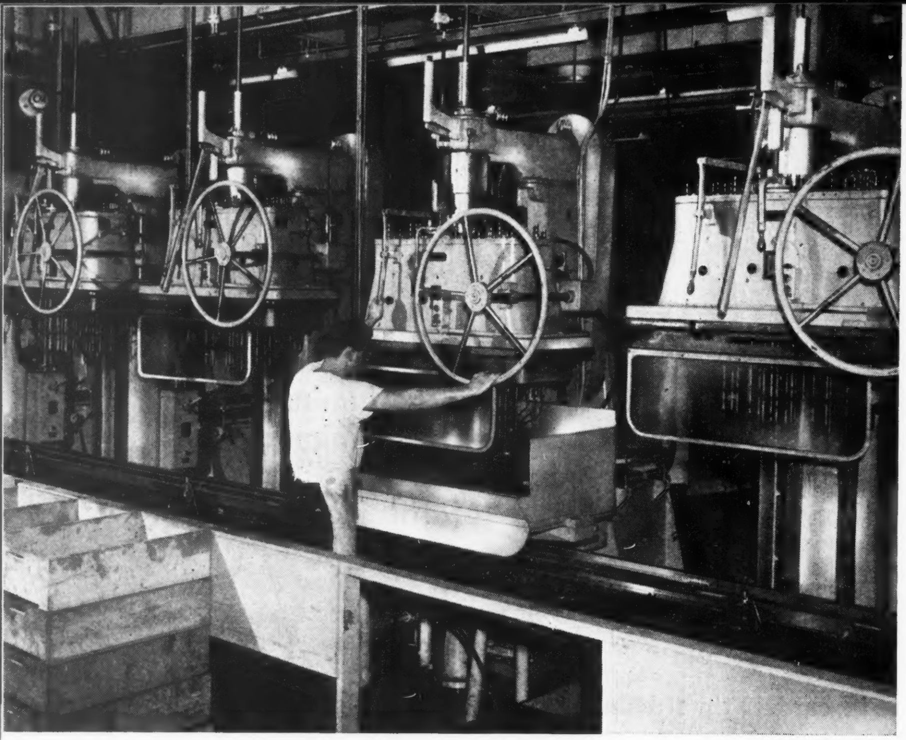


Fig. 2. Nearly all of the drilling and some reaming operations are performed on five multiple-spindle machines that are connected by ways, along which the carriage, holding the casting in a fixture, is moved

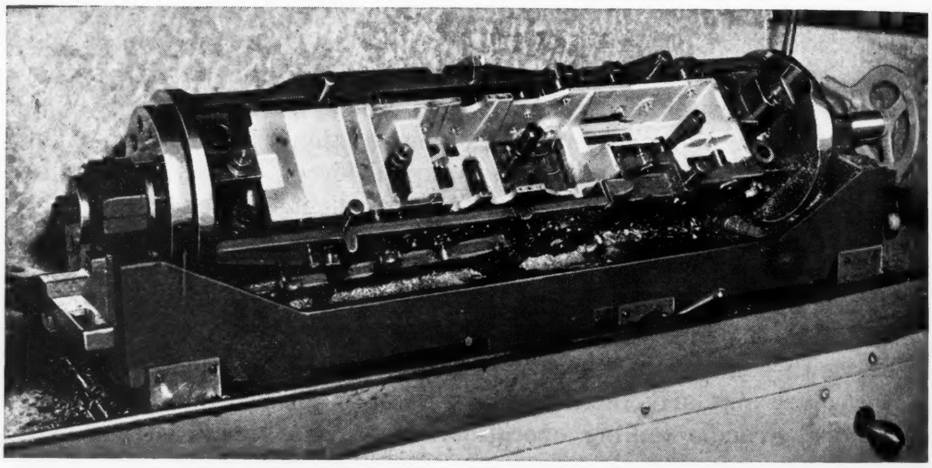


Fig. 3. Box type trunnion fixture used to hold the casting, which is seen in place. The cover of the fixture, containing several drill bushings, has not yet been applied. It is easy to rotate fixture to bring any face into drilling position

in this operation. The cutters are rotated at 2070 R.P.M., and the work is traversed at the rate of 48 inches per minute.

The other two long sides of the casting are milled on the same machine, using a different fixture. In the third set-up, a Kearney & Trecker machine is employed to mill bosses on both ends of the casting and also to make some minor milling cuts. The casting is then ready for the drilling and reaming operations, which are performed on all four long sides of the casting by a row of five Natco multiple-spindle machines, Fig. 2.

These machines are connected by a common track or ways along which a carriage is moved by hand. The carriage is positively locked in the correct position at each station by means of a vertical pin that fits into a hole in the carriage. A box type trunnion fixture, shown partly loaded in Fig. 3 and unloaded with a completely drilled casting beside it in Fig. 4, is mounted on the carriage.

After a drilled casting has been removed at the loading station, the fixture is blown out and a washed casting is set in place and clamped. A plate (not shown) is then clamped to the top face of the fixture. This plate includes the necessary drill bushings, and similar bushings are provided where needed on the other three faces of the fixture.

Because of its trunnion mounting, the fixture is easily rotated to bring any of its four faces to the top, in which position it can be positively locked. Several such shifts are made at or between the stations of the five drilling machines. For performing the required operations at most stations, it is necessary to feed the drill head downward a second time after rotating the fixture through an angle of 90 or 180 degrees. From twenty to thirty holes are produced at each station. When the operations at all five stations have been completed, approximately 120 holes have been drilled and some of these have been reamed.

About four castings per hour are drilled and reamed in this set-up. By using drill bushings,

the required center distances are readily maintained. Adequate precision and a reasonably high rate of production are attained by performing most of the drilling with the casting held rigidly in a single fixture.

However, a particularly high degree of precision is required on several holes, and this is attained by means of three set-ups on Ex-Cell-O precision boring machines, one of which is seen in Fig. 5. These machines are of the double-end type, and each has from three to five spindles per end. All of the spindles on each end are mounted on a hollow, special bridge filled with oil. The temperature of the oil is controlled by a thermostat; hence the distance between the spindles and the height of the spindles above the base are not affected by temperature changes.

Only a simple fixture is needed for locating the casting in the correct position on the table and clamping it securely in the machine. The table carrying the work is fed toward the tools, all of which carry carbide-tipped bits. After the casting is fed toward the set of spindles at one side of the machine, the table is reversed and the casting is fed toward the tools on the other side. The table then returns to its mid-position for unloading. The cycle is automatic, and only one operator is required for two machines.

After the holes in the two opposite sides of the casting have been bored on the first machine, the work is transferred to a second machine and mounted so that the other two long sides are in a vertical position, for boring the holes in these sides. A third machine is required to bore holes not machined in the two set-ups just described. This completes the major machining operations, but several minor ones—chiefly tapping and burring—are performed subsequently.

* * *

Seven states have more than 2,000,000 passenger car registrations each, and California has more passenger cars in use (3,955,351) than all the countries in South America, Central America, Asia, Africa, and Oceania combined.

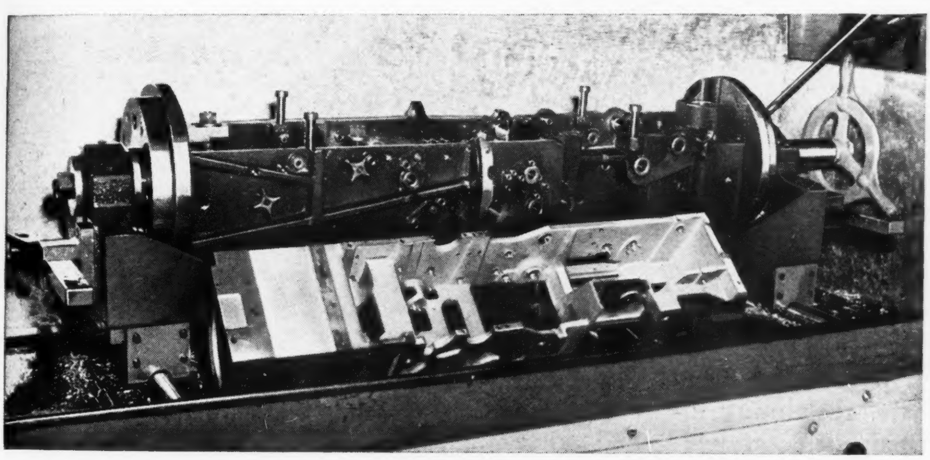


Fig. 4. Here the casting shown in Fig. 3 is removed from the fixture. In this fixture about 120 holes are drilled in four sides of the aluminum casting. Several drill bushings may be seen on one face of the fixture in this illustration

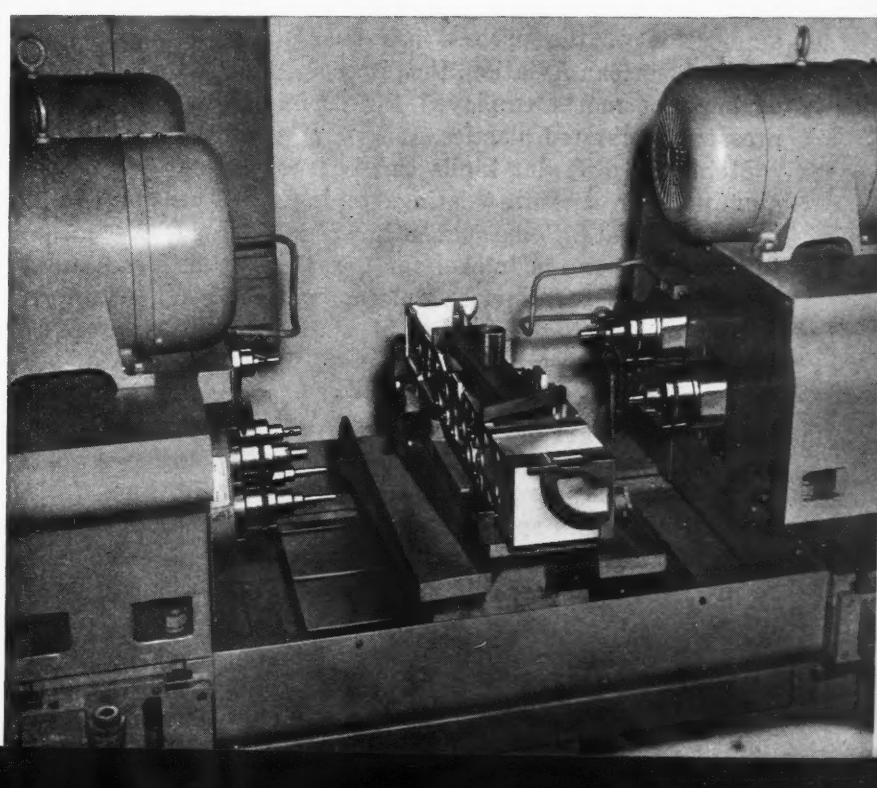


Fig. 5. After being drilled, the aluminum casting comes to this machine, in which two holes are precision-bored in the right side. Carbide tools on the spindles at the left bore five holes in the opposite side

A Unique Application of the Metal Spraying Process is in the Production of Low-Cost Molds for Forming Plastic Parts Required in the Manufacture of Aircraft. The Procedures Employed in Metallizing the Molds are Described in This Article

By
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North American Aviation, Inc.
Los Angeles, Calif.

Producing Low-Cost Molds for Aircraft Parts by Metallizing

METAL spraying has long been used for rebuilding worn parts, reclaiming incorrectly machined parts, and providing a corrosive-resistant covering. A unique application of the process has been made by North American Aviation, Inc., in the production of low-cost molds employed for forming low-pressure laminated plastics.

Metals of different kinds can be sprayed on aluminum or Kirksite castings to improve the working surface. Some success has been attained in using copper and nickel for spraying molds for forming plastic parts. Molds so sprayed are useful for forming small lots of glass laminate parts. Metal spraying over a phenolic matrix will produce a very satisfactory mold. The spraying of ceramics (non-glazed) to a thickness of 1/4 inch has also produced a stable mold. A mold of this type may be polished to a high luster or an additional thin spray of silver solder may be applied to the working surface and then polished to produce the desired finish.

Glass cloth samples have been cured on such sprayed surfaces as silver solder, copper, nickel, and nickel-silver solder. Hydrocal, phenolic, ceramic, aluminum, and Kirksite molds that have been metallized have given satisfactory results in forming low-pressure laminated plastics. A metal-sprayed Hydrocal mold is illustrated at the right in Fig. 1, while a metallized Kirksite mold may be seen at the left. Metal-sprayed molds produced from phenolic matrices are shown in Fig. 2, and a nickel-sprayed aluminum casting is illustrated in Fig. 3. These parts were each metallized with two or more metals, such as zinc, copper, aluminum, nickel, silver solder, and nickel-silver solder.

Removable molds have been produced by spraying copper and silver solder on both phenolic plaster and ceramic matrices. A phenolic matrix is preferable because of its ease of manufacture, porosity-free surface, and dimensional and heat stability qualities. A phenolic matrix can be made from a standard plaster, whereas

with a ceramic matrix, compensation must be made for shrinkage.

The method of producing these molds is a simple one, which results in a large saving in their manufacture. The first step in the process is the construction of a plaster master. From this a plaster splash is made, the splash being processed for phenolic matrix lay-up. For small molds, the phenolic matrix may be phenolic-impregnated glass cloth laid upon a gel coated surface, while for large molds, a conventional phenolic casting may be used. The matrix must be prepared for spraying by cleaning with acetone or carbon tetrachloride.

After cleaning, the matrix is first sprayed with silver solder to the desired thickness (0.010 to 0.030 inch) and then a 1/16-inch coating of copper is sprayed on top of the silver solder. In all metal-spraying operations, the metal must be evenly applied over the whole matrix. This stops the metal from pulling away from the matrix. This is followed by the application of a coarse-mesh copper screen or metal bulkheads, bonded with additional copper spray. The desired thickness is obtained by continuing to spray with copper. At this point, copper heating tubes are installed, metal-sprayed copper being used for attaching the tubes to the mold.

The next operation is to attach a back-up frame and baseplate to the mold by mechanical means and spray with copper. The frame may take the form of a box, leaving an opening through which Hydrocal can be poured. The cavity between the frame and the mold is then filled with Hydrocal, after which the open end of the box frame is closed. The last step is to remove the complete mold from the matrix and polish the silver-solder surface.

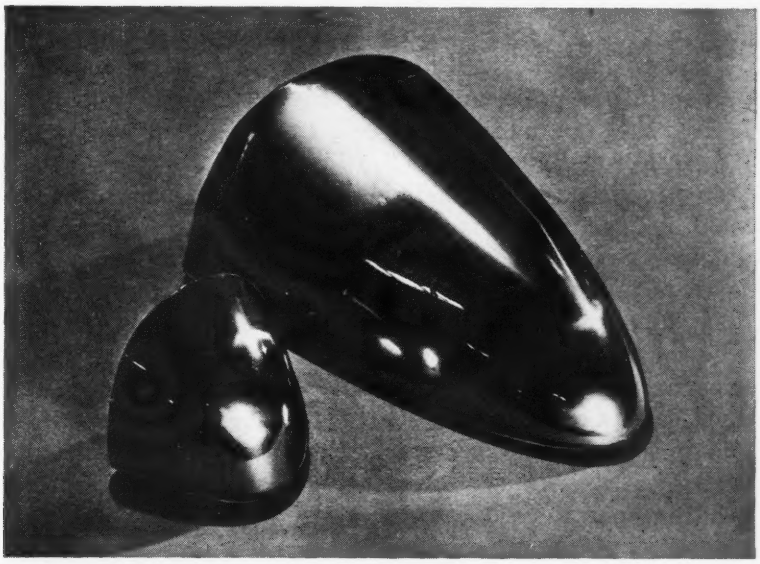

Fig. 1. Metal-sprayed molds used in producing plastic aircraft parts. The one seen at the left is metallized Kirksite, and that at the right is Hydrocal

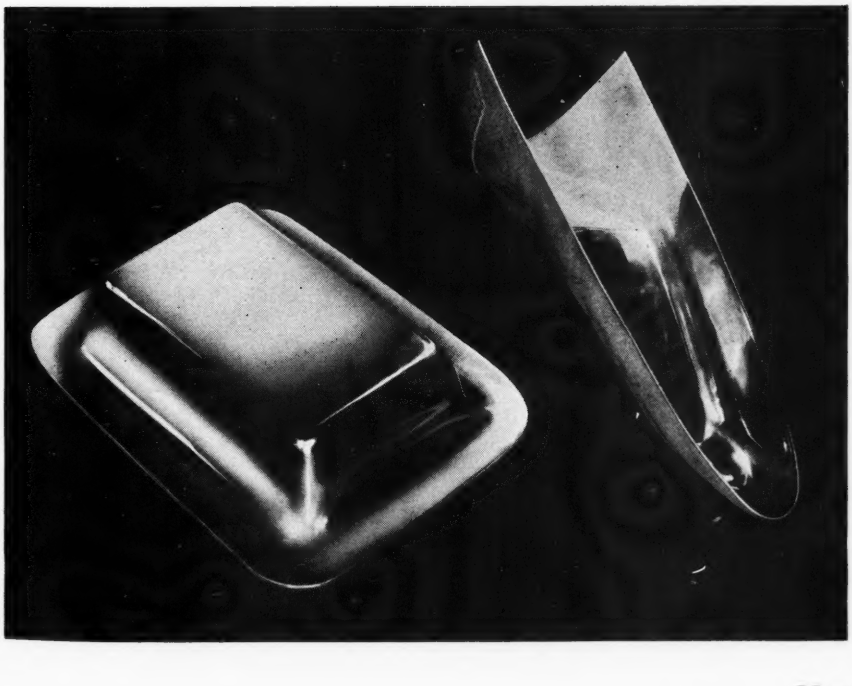

Fig. 2. Metal-sprayed molds produced from phenolic matrices, employed to produce complex aircraft shapes

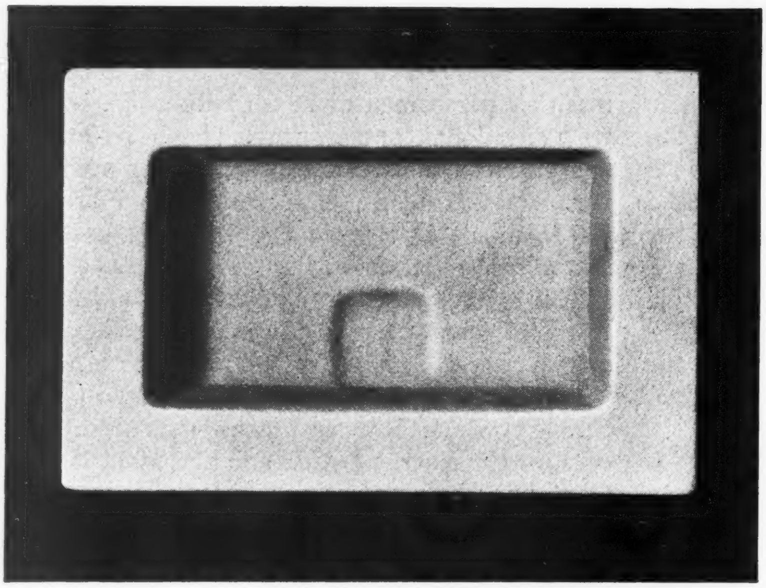

Fig. 3. A nickel-sprayed aluminum casting used in the manufacture of airplanes

The wire mesh or bulkheads are used to give stability and strength. The phenolic matrix must be smooth and clean. Copper metal spray has proved to be the best metal for this type mold. A mold shell having the shape of a 12- by 18-inch Pyrex cake dish, with walls 3/16 inch thick, has been produced by the method described. This mold, not including the heating tubes and back-up, was completed in 2 3/4 man-hours, using seven pounds of copper wire.

It is recommended that an exhaust booth be used for spraying operations on work other than experimental jobs. The object to be sprayed must be kept clean at all times. A portable sand-blast machine would be an aid. Many hours have been lost between the spraying and the sand-blasting operations due to handling and soiling of the matrices en route. For large parts, such as the radome molds seen in Figs. 4 and 6, a large size spray gun is desirable. The metal-sprayed molds illustrated in Figs. 5 and 7 were made for plaster breakaways.

A typical example of an inexpensive radome mold produced by metallizing is shown in Fig. 4. In this case, the matrix—a duplicate of the radome plaster master—was made of Palestic solution and white Hydrocal. The Palestic provides a hard, smooth surface. The matrix was covered with Platon solution, which forms a thin layer of phenolic on the surface. Platon was used because it gives a smooth surface, and at the same time, acts as a sealing agent, preventing moisture from seeping through the plaster while the metal is being applied.

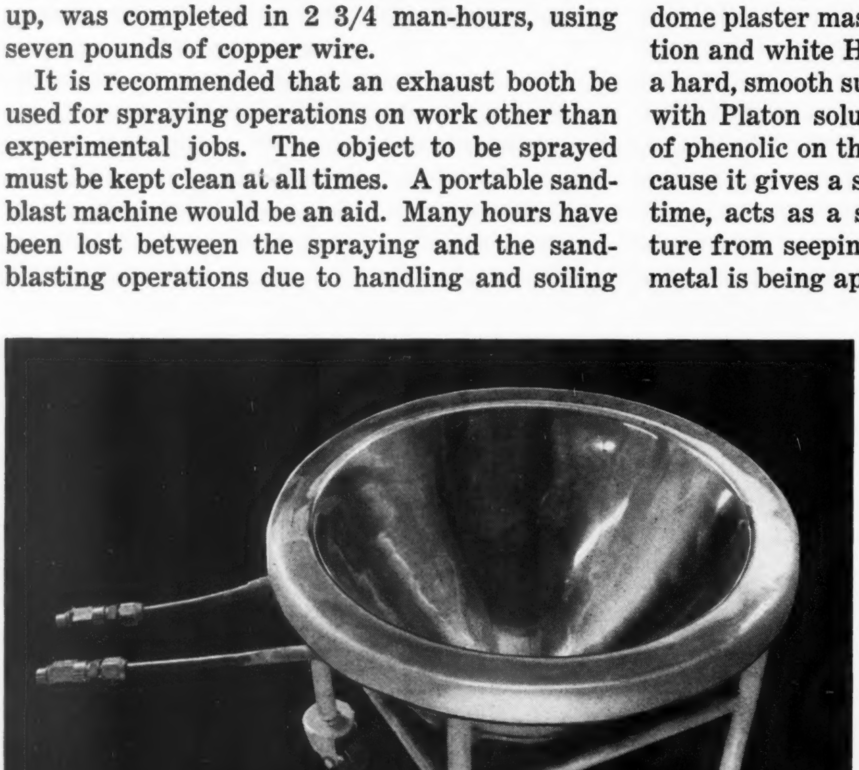

Fig. 4. Mold for aircraft radomes, produced by spraying bronze, copper, aluminum, and nickel on a Palestic solution and white Hydrocal matrix

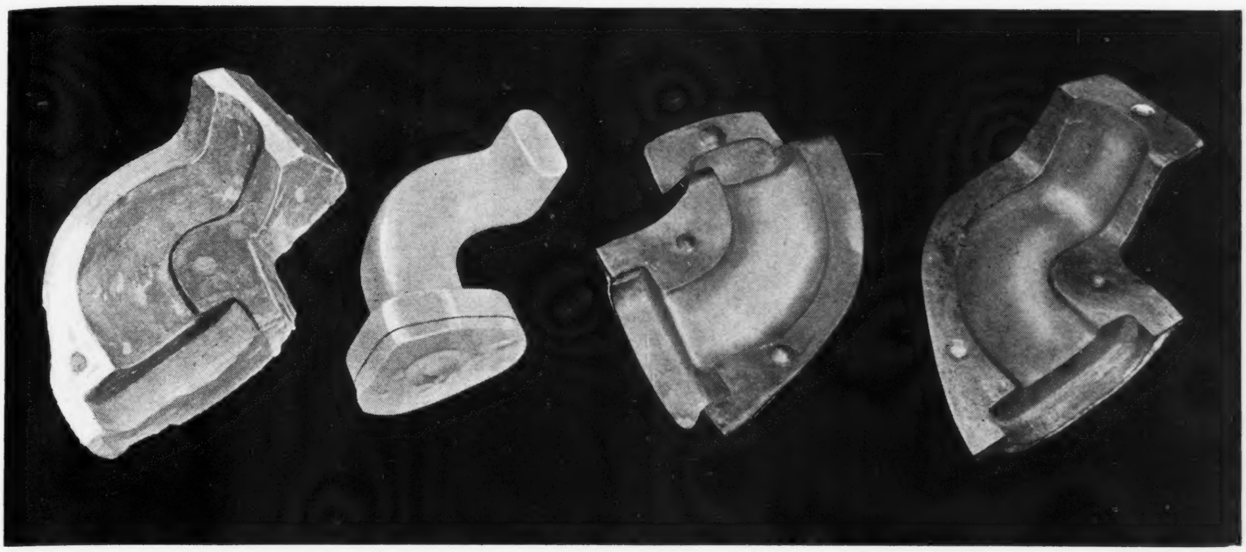

Fig. 5. Plaster breakaways and metal-sprayed molds used in producing them

The completed matrix was lightly sanded to insure a clean surface and enable the proper bond to be produced when the first layer of metal was applied. It was then placed on a temporary wooden revolving table and metallizing was begun. A total of 157 pounds of metal was sprayed in eight applications to form the mold. Bronze, copper, aluminum, and nickel wire of various diameters was used. Twenty feet of 5/8-inch diameter copper heating tubing was installed between the fifth and sixth applications of sprayed metal. The tubing weight was 20 pounds. The total loss of metal amounted to 24 pounds, 15 of which were lost in trimming to release the mold from the matrix and 9 in spraying. The minimum thickness of the completed mold was 3/16 inch, and the maximum (at the heating tube areas) was 3/8 inch. The completed mold weighed 148 pounds.

In removing the mold from the matrix, excess metal, sprayed around the flanges for bonding, was cut off with a band saw, after which the mold and matrix were subjected to a heat of 350 degrees F. for 1 1/2 hours. The mold was then easily released from the matrix. After being allowed to cool normally to eliminate cracks, the mold was placed in a wooden frame to facilitate handling and decrease the possibility of damage.

The polishing of the working surface was done at this stage. The removal of approximately 0.005 inch of material was necessary to obtain a smooth finish. As far as dimensional stability was concerned, the over-all contour of the finished mold was checked and was found to be cor-

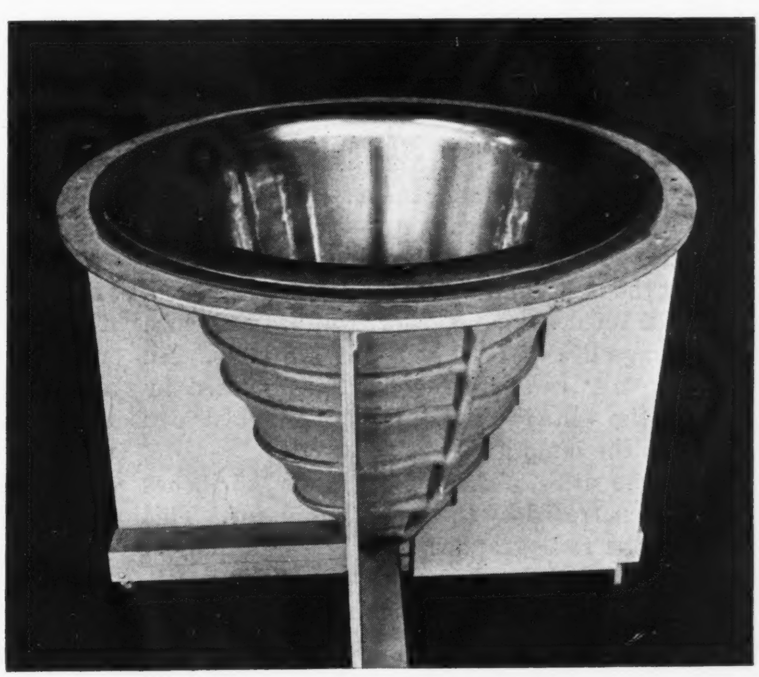

Fig. 6. Another example of a metallized low-pressure laminated-plastic mold for producing aircraft radomes

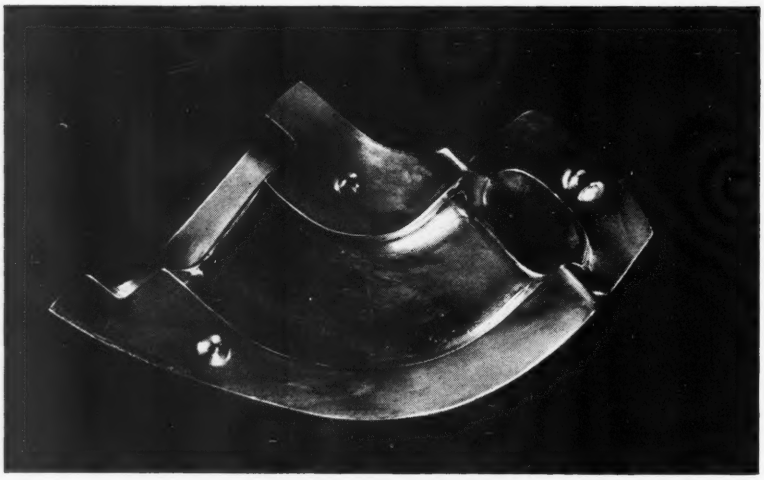

Fig. 7. Mold for a plaster breakaway similar to those shown in Fig. 5. This mold, like the other examples shown, was produced by the metal-spraying process

rect within a tolerance of plus or minus 0.010 inch. This is acceptable in a part of this size and shape, although the periphery of the mold could have been held to a closer tolerance by improvements in design.

This mold proved to be suitable for a vacuum lay-up only, as the metal thickness would have to be greater if a pressure plate were used for applying internal air pressure.

Tests conducted in making molds and temporary tools of sprayed metals indicate that many of the molds and dies now being made by other methods can be produced at substantial savings in cost by metal spraying. At present, however, the utilization of metal spray for molds is limited to those used for short runs. The dimensional stability of a metal-sprayed mold is good, but is not equal to that of an electroformed mold, nor is the surface finish as good. The durability can only be determined over a period of time, although the production cycle will probably be very high. Metallized molds are light in weight, but must be carefully handled because of the brittleness of the metal. Recent developments in metal spraying promise a widening application in the production of low-cost tooling.

High-Intensity Illuminator for Viewing Industrial X-Ray Films

An iris-diaphragmed, high-intensity viewer that permits a study of the widest range of X-ray film densities thus far possible in the industrial field, has been developed by the General Electric Co., at Milwaukee, Wis. The wide range of viewable densities is accomplished by two features. First, the opening can be steplessly dilated or contracted—like a cat's eye—from a 1/4-inch triangle to a 5-inch diameter circle, thus concentrating the light on the area in question. Second, a special 100,000 candlepower lamp is used, with an average life of 1000 hours at 115 volts. An even greater candlepower can be obtained by raising the voltage to 135, though this overload shortens the lamp life.

Film densities of from 0.5 inch to 4.5 inches can be penetrated by the new illuminator. This enables the radiographer to diagnose an object of greatly varying thicknesses with only one exposure. It also eliminates the need for re-takes on over-exposed films. In order to see through such films, it is merely necessary to turn up the light intensity.

Low cost of the unit is due to the long lamp life and other savings effected in industrial use. The new unit greatly reduces the man-hours required in taking extra X-ray films (to insure that varied thicknesses are properly penetrated), eliminates the cost of the extra films, and cuts the man-hours spent in viewing them.

Recessing of the controls behind the surface of the illuminator makes it possible to move the radiograph to view any area desired without accidentally touching the controls. Use of a foot-switch leaves both hands free for manipulating the radiograph. Cleaning the lenses and the face of the lamp and replacing the lamp can all be done without the use of tools. The circuit is so wired that the lamp cannot be energized unless the blower system is on. The glass panel, with filter protection, remains cool, thus shielding the films from lamp heat.

Reference Radiographs for Inspection of Aluminum and Magnesium Castings

By J. J. PIERCE, Metallurgist
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STANDARD radiographic terminology to be used for defects in aluminum and magnesium castings is illustrated in a manual prepared by the Naval Ordnance Laboratory under a project sponsored by the Bureau of Aeronautics. In addition to promoting the use of a standard terminology among designers, manufacturers, inspectors, and customers, it is believed that this manual will provide material for instruction in the interpretation of radiographs. The manual is not in final form, since the collection, selection, and checking of data on the strength of materials containing defects is still under way.

In the preliminary planning for this manual, two considerations were paramount. First, that since much of the impetus and planning for radiographic standards had originated in the aircraft industry and in governmental agencies, a coordinated effort was mandatory. Thus benefit from the experience of others would be gained and duplication avoided. Second, that the scope should be limited to a point that would enable some useful material to be made available within a reasonable time.

The scope, as later formulated included the preparation of radiographs that would identify any discontinuities (breaks in the homogeneity of the metal) occurring in aluminum and magnesium alloy castings. It was decided that several degrees of each type of discontinuity would be illustrated for each alloy in which it occurs. The tentative ASTM terminology E52-49T was to be used where applicable. Also, the grade of each discontinuity, corresponding to the minimum acceptable quality for castings in general, was to be established on the basis of experience and good judgment. Mechanical and metallurgical testing were to be deferred to the second phase of the project.

In order to obtain the radiographs and castings required for this task, and utilize all the available experience, it was necessary for the project engineer to contact representatives of aircraft manufacturers, foundries, and X-ray laboratories. Simultaneously, the technique for reproducing radiographs had to be standardized, so as to obtain radiographs of a standard density while retaining the original contrast required to provide for both film and paper prints.

Observations resulting from the survey indicated that there was no standard industrial X-ray terminology in general use. The ASTM terminology, where known, is acceptable to most film interpreters and inspectors, but is incomplete without illustrations. It is inadequate for expressing the cause of defects, but, in the interest of simplicity, is accepted as a general terminology and expanded locally to fulfill the needs of foundrymen.

The diversity of paper forms used throughout industry to report the findings and decisions of the X-ray film interpreter may result in as much confusion as the various terms do. This is due in part to the absence of standards illustrating grades, as well as types of discontinuity. There is still some misinterpretation of radiographs, that is, errors in simple identification of type of defect.

The representatives of the companies contacted were in favor of a book of standard illustrations. Some felt that as many as twelve grades were necessary to distinguish varying amounts of porosity, whereas one illustration of crack, shrinkage, foreign material, gas hole, etc., would be sufficient. It was generally agreed that the appearance of most defects is almost identical in different alloys of the same base metal. However, aluminum alloys with a high magnesium content tend to resemble the magnesium-base alloys in radiographic appearance rather than the other aluminum alloys.

It was found that more attention was being given to the surface condition of castings, probably as a result of recent reports on fatigue testing. Many alloys, particularly magnesium-base alloys, are known to be highly notch sensitive. More attention to visual inspection with the aid of fluorescent and other penetrant techniques was favored.

The survey and contacts resulted in decisions relative to the future conduct of the project. The basic requirements for the application of radiography in the procurement of aircraft castings had to be dealt with first. In order to provide a

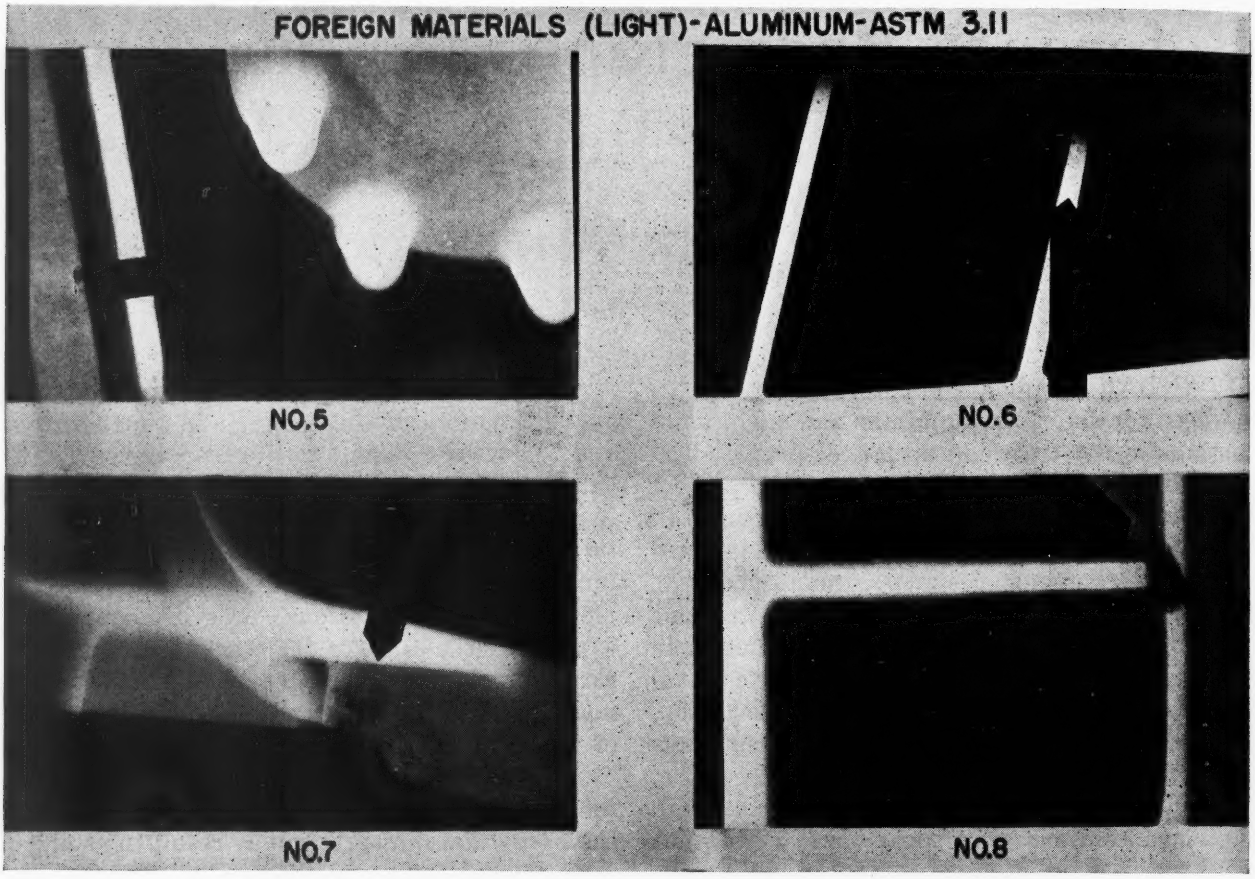


Fig. 1. Reproduction of one page from the Bureau of Aeronautics "Manual of Illustrations of Defects in Aluminum and Magnesium Castings"

common terminology, the ASTM terminology was adopted for the purpose of the project. A book of illustrations was required which would show all the discontinuities found in light alloy castings. It was decided that, in some cases, six or eight degrees of a certain type of discontinuity would be illustrated, while in others, one or two degrees would be sufficient. The following casting alloys were to be included: Magnesium H and C; aluminum 195, 355, 356, B195, and 40E. Only sand and permanent-mold castings were to be considered, other non-ferrous alloys and casting techniques being deferred to a later date. It was also agreed that the book should be reproduced in quantity in the form of film rather than paper prints, and given the widest distribution feasible as soon as possible. Comments on interpretation based upon experience, judgment, and available test data were to be included as an appendix, and perhaps some suggestions relating to the use of the illustrations could be included within the preface.

Mechanical testing data that correlated the material properties with the radiographic image of a discontinuity might be added to the book. Much information of this type is now available; however, since the reasons for performing the tests have been quite varied, there is an equal variety in the approach to the evaluation of the discontinuities. Many types of samples have been tested in tension, fatigue, torsion, impact, and corrosion. While much of this data is sound and based on large sampling, only general statements indicating trends could be incorporated in the book unless a complete statement of all test conditions were included.

Over 500 radiographs were received from the industrial sources contacted. Many of these were indexed and labeled with the ASTM code and degree of discontinuity. Also, approximately 200 aircraft castings demonstrating a wide range of types and degrees of discontinuities were procured and radiographed at the Naval Ordnance Laboratory.

A technique for reproducing the radiographs was developed and standardized. A film density of about 1.5 was selected as practical for ease in viewing the standard films. Approximately 200 radiographs were selected from the file and reproduced as tentative illustrations. From these, 108 were selected as standard illustrations, and six loose-leaf books were prepared. The accompanying illustrations show a few of the radiographs in the books. Fig. 1 is a reproduction of a single page in one of the books, and Fig. 2 is a composite photograph showing two of the

four illustrations appearing on each of four pages.

The prime objective of future phases of this program is to collect sufficient data to enable an engineer to design a casting without introducing a large casting safety factor, and to make an intelligent, non-arbitrary choice of a standard for a given application.

A secondary objective is to better illustrate the nature of certain discontinuities—that is, porosities, sponge shrinkage, and segregation. Microradiographs and photomicrographs have been made from slices cut from castings previously radiographed at the Naval Ordnance Laboratory. These will be added to the book of illustrations, but they do not answer such primary questions as: What is the strength of alloy A-HT containing Defect 2 Grade 1? The engineers are not asking for data from tests applied to structures—they have that. They require data on strength of materials containing discontinuities.

Available literature has been reviewed, and although there is considerable information, many of the tests described were performed for a specific purpose, and do not suggest a test program applicable to this project. Other suggested programs involve the expenditure of large sums of money over a period of many years. This may be desirable in view of the fact that the data sought are basic; however, it is not practical now.

What, then, should be undertaken during the next year or two? It will be necessary to limit the investigation of any discontinuity to two or three degrees. Since certain alloys are normally specified for a particular application when a certain property is required, that property will be investigated with samples containing discontinuities most likely to occur in that alloy.

For example, a certain alloy of composition A with treatment B is known to be very tough in service and is often specified for landing gear parts. Perhaps it is difficult to cast this alloy without some shrinkage sponge. A pattern will be designed to produce slabs or some simple forms of casting in which this discontinuity can be obtained in varying degrees, and a number of impact test specimens will be prepared. The test results and corresponding radiographs thus obtained can be incorporated into the manual.

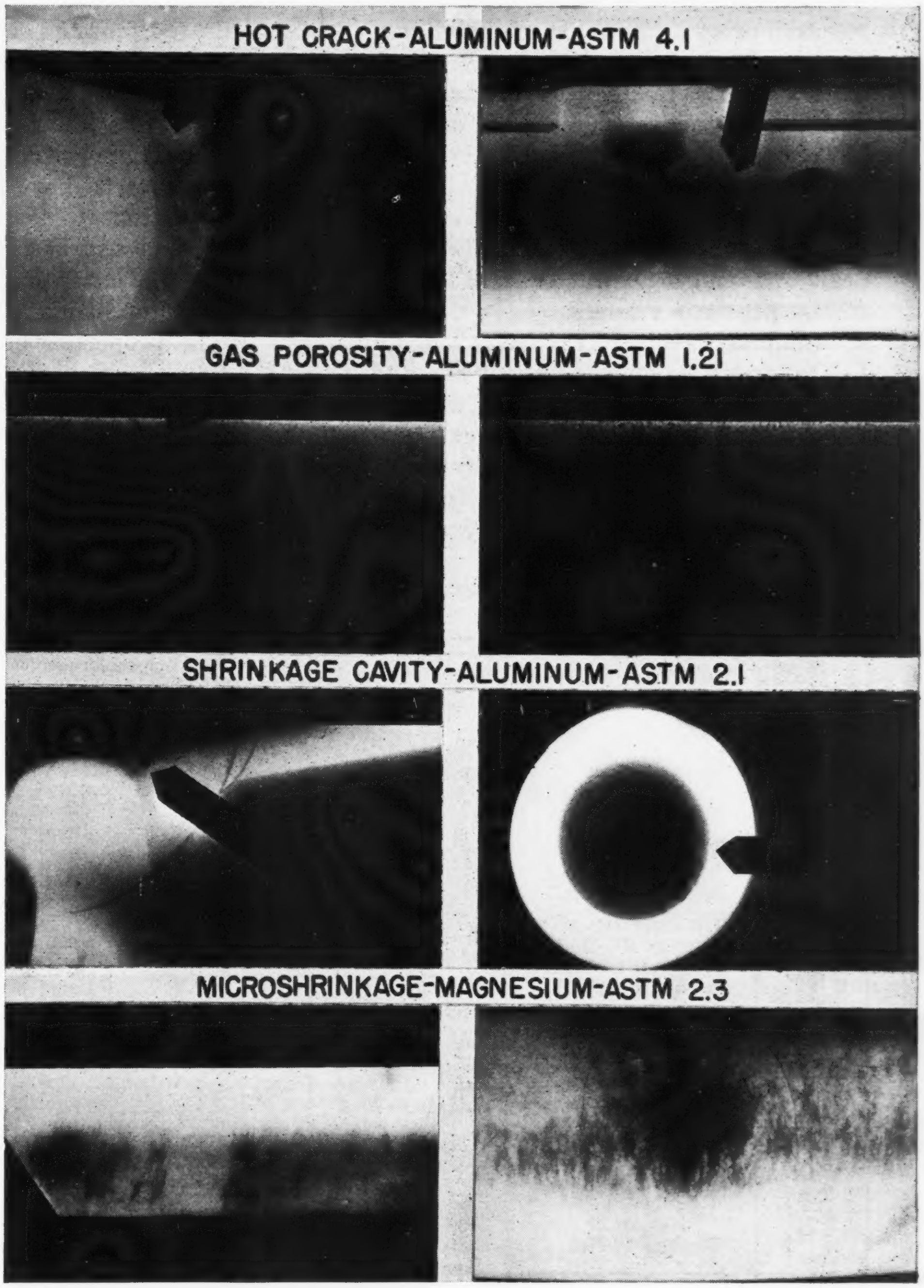


Fig. 2. Examples of the radiograph reproductions used to illustrate standard terminology for defects occurring in aluminum and magnesium castings

Solving Titanium

This Article, Based on a Report to the Air Materiel Command of the United States Air Force, Describes the Machinability Characteristics of Various Titanium Alloys

THE present status of titanium may be compared with that of aluminum in its early stages, and it will probably be some time before the potentialities of this comparatively new metal are fully established. However, valuable information on the machining of titanium has been obtained as the result of a research program on the machinability of metals conducted by the Curtiss-Wright Corporation, the Ford Motor Co., Metcut Research Associates, and the Massachusetts Institute of Technology. In the second of two reports to the Air Materiel Command of the United States Air Force, published in book form by the Curtiss-Wright Corporation, the subject of machining titanium is dealt with and is abstracted here for the benefit of MACHINERY'S readers.

Titanium is a silver-gray metal weighing about half as much as steel, or about one and a half times as much as aluminum. Two of its most important properties are an extremely high strength-weight ratio (in the alloy form), which exceeds all usual materials, and excellent corrosion resistance. Titanium alloys, unlike most other light metals, retain their strength at temperatures up to about 800 degrees F. Endurance limit and fatigue characteristics appear to be excellent. The accompanying table gives the compositions and physical properties of titanium alloys compared with those of other engineering materials.

Pure titanium is comparatively soft and weak, and also extremely difficult to refine. Commercially pure titanium contains enough impurities to alloy the material considerably, with an attendant improvement in mechanical properties. Metallurgists have been trying various alloy combinations to develop high-strength materials. Those now in use contain chromium and iron, chromium and aluminum, manganese and aluminum, or manganese alone.

The properties of titanium are of great importance to the aircraft industry (high strength, light weight, high endurance limit, and corrosion and heat resistance), and most of its experimental applications are in this field. Among the metals extensively used in the aircraft industry, the austenitic stainless steels come the closest to

Composition and Physical Properties of Titanium

	Material	Approximate Compositions, Per Cent												
		Iron	Carbon	Chromium	Nickel	Molybdenum	Cobalt	Aluminum	Manganese	Titanium	Columbium	Copper	Magnesium	Tungsten
Light Metals	Titanium 150 A	1.3	....	2.7	....	....	....	....	....	Bal.	....	....	....	....
	Titanium RC-130-B	....	....	....	....	....	....	4	4	Bal.	....	....	....	....
	Titanium L-2748	....	....	5	....	....	....	3	....	Bal.	....	....	....	....
	Aluminum 24S-T4	....	....	....	....	....	....	Bal.	0.6	....	0.8	4.5	1.5	....
Steels	AISI 347	Bal.	0.08	18	10	....	....	....	....	....	0.8	....	....	....
	AISI 410	Bal.	0.15	12	....	....	....	....	....	....	....	....	....	....
	AISI 430	Bal.	0.12	16	....	....	....	....	....	....	....	....	....	....
	AISI E4340	Bal.	0.40	1	1.8	0.3	....	....	0.75	....	....	....	....	....
High-Temperature Alloys	S-816	Bal.	0.4	20	20	....	43	....	....	....	4	....	....	4
	Inconel "X"	8	....	15	73	....	....	0.7	....	2.5	1	....	....	....
	Refractaloy 26	Bal.	0.03	18	37	3	20	0.2	0.7	2.6	....	....	....	....
	Discaloy 24	Bal.	0.03	13	26	3	....	0.1	0.8	1.6	....	....	....	....
	Timken 16-25-6	Bal.	....	16	25	6	....	....	....	....	....	....	....	....

Machining Problems

titanium in giving an approximate concept of how the new material can be expected to machine.

Tests show that titanium is considerably more difficult to machine than stainless steel, and that it is better to classify it with the less familiar high-temperature jet-engine alloys. In fact, comparing titanium with stainless steel is justifiable only in that both alloys are highly work-hardenable and cut with a tough, stringy chip. To this extent, the comparison serves as a starting point for new users of titanium alloys. The tool life versus cutting speed charts presented in Figs. 1 and 2 give comparative data for titanium 150A, AISI 347 stainless steel and some of the high-temperature alloys from which turbine discs and buckets are made, using carbide and high-speed steel tools, respectively.

One of the important operations on titanium is the clean-up of billets in a lathe prior to all forging and rolling operations, as indicated in Fig. 3. The surface condition of these billets is poor because of casting pits, slag inclusions, hard particles, and contaminated alloy. These defects must be removed before the billets are processed, in order to avoid distributing the contamination throughout the finished product and to prevent damage to forging and rolling tools.

Some improvement in the surface has been effected by sand- or shot-blasting and by etching—in some cases to a depth of 0.008 to 0.012 inch. The worst defects are eliminated by scarfing or snagging.

Turning is the easiest metal-cutting operation to analyze. For many reasons, it offers the simplest method of comparing machining properties of different materials. Machinability tests of wide magnitude and scope on titanium alloys are just beginning.

Other machining operations, although basically similar to turning, are vastly more complicated. Comparative test findings on milling, drilling, and the other operations immediately introduce an array of variables. Factors such as cutter diameter, number of teeth or flutes, and helix angle—to mention a few—make the analysis more difficult. Comparative information may be misleading, therefore, unless tests are conducted under identical conditions.

The available data on milling and drilling at the present time are all of a preliminary trial nature, undertaken to determine the best course to follow in more detailed test work. A few isolated findings are given. In general, it can be said that titanium alloys can be machined fairly satisfactorily at speeds in the vicinity of 70 feet per minute.

One company's experiments in milling made in January, 1951, are interesting. According to these, 18-4-2 high-speed steels have been found

Alloys Compared with Other Engineering Materials

Approximate Properties									
Melting Range, Plus and Minus 50 Degrees F.	Density, Pounds per Cubic Inch	Magnetic	Test Condition for Mechanical Properties	Ultimate Tensile Strength, Pounds per Square Inch × 1000	Yield Strength, Pounds per Square Inch × 1000	Elongation in 2 Inches, Per Cent	Area of Reduction, Per Cent	Modulus of Elasticity, Pounds per Square Inch × 10^6	Brinell Hardness
2950	0.17	No	Annealed	150	130	15	40	15	300
2950	0.17	No	Annealed	145	135	15	40	15	300
2950	0.16	No	Annealed	165	150	10	35	18	350
1050	0.10	No	Solution-treated and Aged	68	45	20	50	10	120
2525	0.29	No	Annealed	85	40	55	60	29	250
2725	0.28	Yes	Quenched and Tempered	150	130	20	65	28	300
2675	0.28	Yes	Annealed	70	40	35	70	29	150
2650	0.28	Yes	Quenched and Tempered	150	130	20	55	30	300
2400	0.31	No	Solution-treated and Aged	140	67	35	30	35	300
2570	0.30	No	Solution-treated and Aged	160	90	25	30	31	300
2570	0.30	No	Solution-treated and Aged	180	110	25	45	30	300
2570	0.29	No	Solution-treated and Aged	145	105	20	25	28	300
2560	0.29	No	Work-hardened	135	100	15	20	28	300

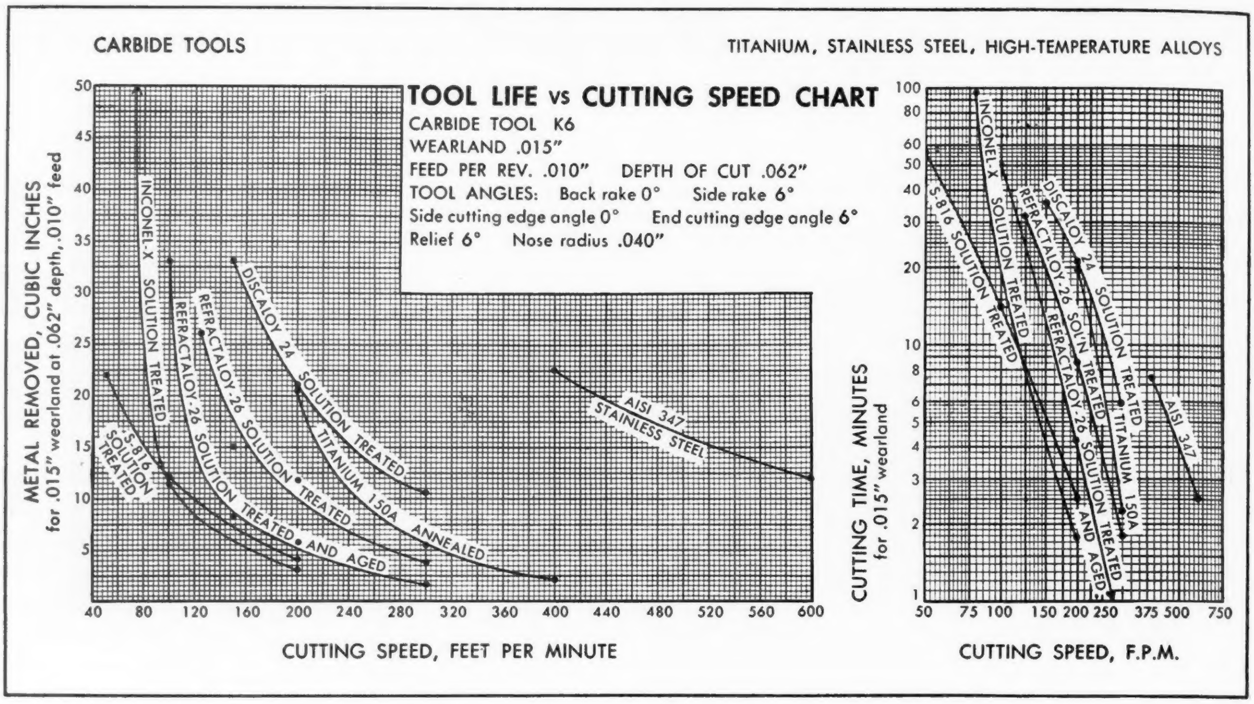


Fig. 1. Chart showing the comparative life of carbide tools used in machining 150A titanium, an austenitic stainless steel, and several high-temperature alloys

to be about the best of the steel tool materials, and cast-alloy cobalt-chromium tools have been found to be superior to carbide tools. One trouble in milling with carbide tools is that carbide sections tend to flake off, due to the combined effects of intermittent cutting and the "welding" of chips to the tool face. Axial-flow compressor blades are being made from 150A titanium as a possible substitute for AISI 410 stainless steel. Data on machining follow.

With Tantung side- and end-mills, 4 inches in diameter, operating at about 90 feet per minute (75 R.P.M.), tool life was approximately 150 pieces per cutter grind. With Vasco Supreme high-speed steel end-mills, 2 1/4 inches in diameter, the ends of 1 1/4- by 1 1/2-inch bars were

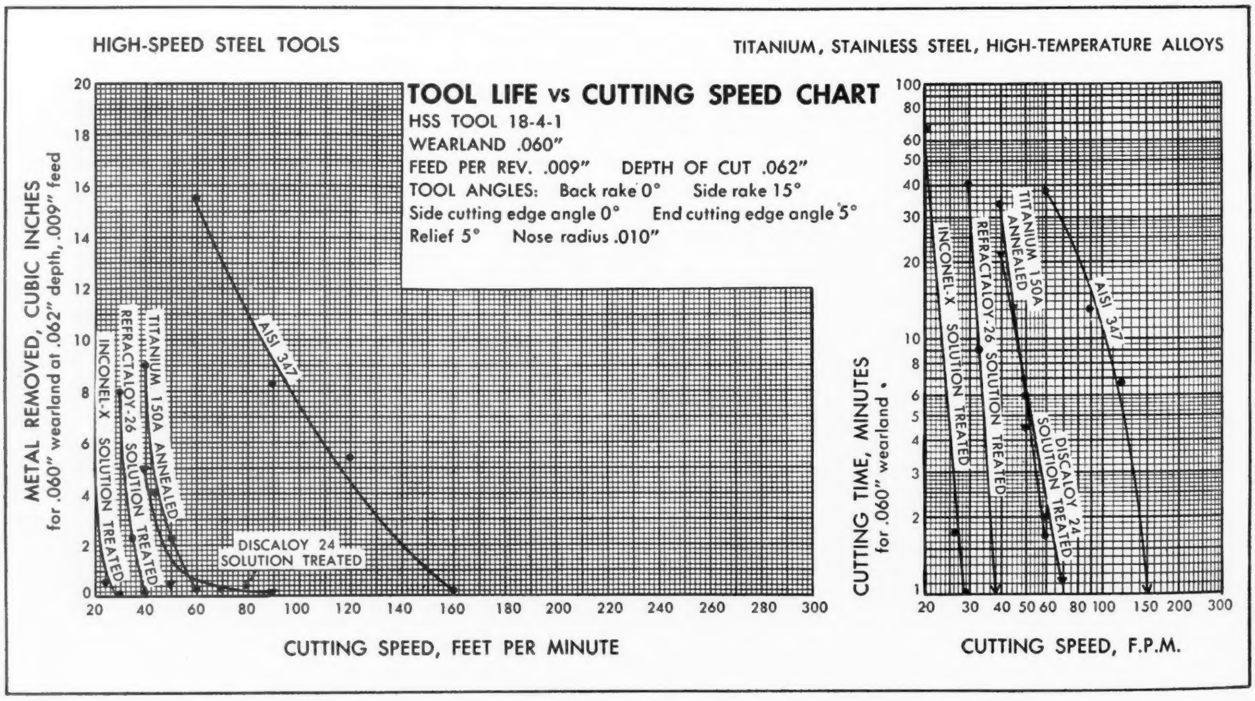


Fig. 2. Chart showing comparative life of high-speed steel tools used in machining 150A titanium, an austenitic stainless steel, and several high-temperature alloys

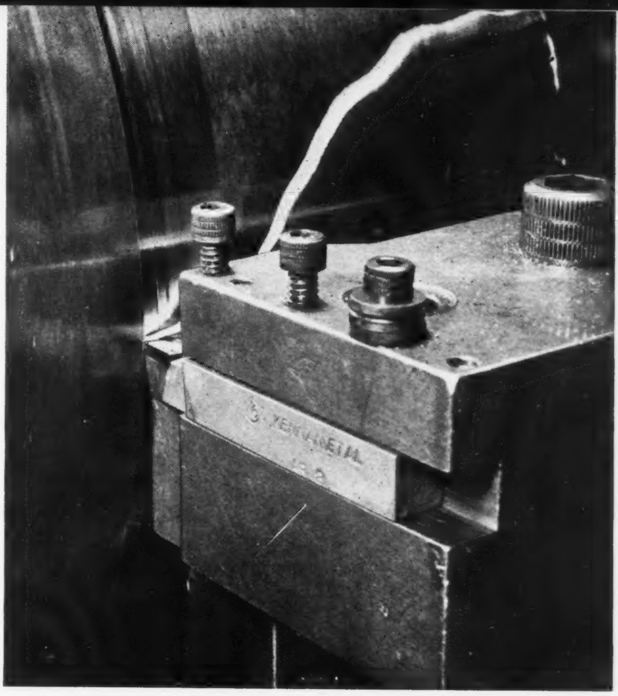


Fig. 3. Cleaning up a cast titanium ingot prior to forging. Note the non-curling chip, which is typical of titanium alloys

milled square to length at about 50 feet per minute (92 R.P.M.) with 1/8 inch depth of cut and 1 inch per minute table feed. Tool life was about 120 pieces between grinds (about 25 cubic inches of metal removal).

Reports on sawing titanium vary from "difficult" to "almost impossible." Band sawing appears to be impractical; the Motch and Merryweather saw seems to work with fair success; and certain types of hacksaws give promise. Abrasive sawing is apparently best, provided proper equipment is used.

In abrasive sawing of titanium, it is impossible to plunge straight through a large piece. The wheel must cut successive overlapping shallow scallops, keeping the area of wheel contact as small as possible and giving the coolant maximum access. If possible, the work should be slowly rotated or indexed, so that the wheel can cut toward the center and will never have to cut more than half way through.

Machines having a wheel-head that has an oscillating as well as a plunging motion are ideal for this purpose. The poor heat conductivity of titanium requires the maximum flow of coolant if heat cracking is to be avoided. Minimizing the wheel-work contact area also prevents the tendency of the wheel to become clogged.

A soluble-oil type coolant is available that kills the objectionable rubber-wheel odor. Titanium bars 7 inches in diameter have been cut, by rotating the work and oscillating the wheel, in ten minutes (about 14.2 seconds per square inch). A 1-inch bar has been cut in four seconds.

Considerable promise is shown in the abrasive cutting of titanium at lower wheel speeds. Wheel speeds of 3000 to 4000 feet per minute (instead of the usual 5000 to 6000) have been tried with good results; at these speeds, wheel wear is reduced appreciably.

In hacksawing, recommendations indicate the need of an extremely coarse saw (two to four teeth per inch), slow speeds, and heavy feeds. Ordinary fine-toothed saws and conventional feeds result in a very small feed per tooth. With titanium, this results in rapid work-hardening which makes further cutting extremely difficult.

Because of the rapid and extreme work-hardening tendency of titanium alloys, the feed should not be disengaged while the tool is in moving contact with the work. This applies to all machining operations, but is particularly important in drilling. For this reason, pilot holes are "out" and the enlarging of holes is to be

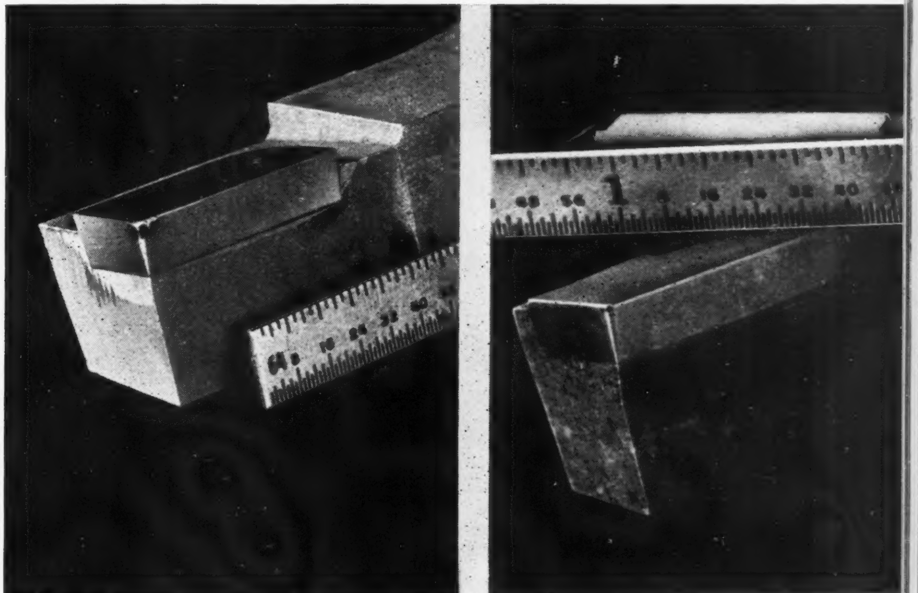


Fig. 4. The carbide cutting tool at the left (Kennametal grade K3H) wore to the extent shown (which was considered excessive) after machining 55 square inches of titanium. Under identical conditions, grade K6 (right) exhibited almost negligible wear

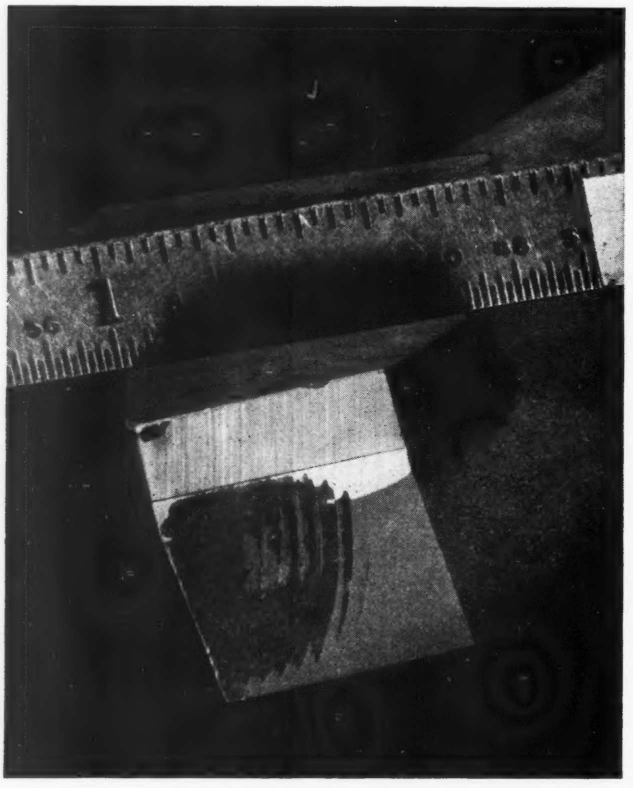


Fig. 5. A general-purpose grade of carbide tool (Kennametal grade KM), while wearing somewhat less than grade K3H under the same conditions, was still considered unsatisfactory

avoided. Poor thermal conductivity and a strong "pick up" or "welding" tendency are two more properties of titanium that require special techniques, and the tough, non-curling type of chip further complicates drilling and tapping because of space restrictions.

Eccentric drilling with high-cobalt steel drills having notched lips, using slow speeds and about double the feed common with steels, offers promise of giving improved results. In this method, the next smaller size drill than is ordinarily required for the hole size is used, with the point ground off center in order to produce a run-out that results in a larger drilled hole. This minimizes rubbing and reduces pick-up and heating.

The notched-lip idea when applied to tapping results in the use of staggered-tooth taps, which tends to break up chips. Use of a 60 per cent thread and a tapping speed of 12 to 15 feet per minute are also recommended.

Extensive preliminary tests on the 5 per cent chromium, 3 per cent aluminum titanium alloy have been made by the Lockheed Aircraft Corporation. Selected data on the development of turning and milling techniques are given in the following:

Turning tests were made with carbide tools of several makes, cast-alloy tools, and high-speed steel tools. Of the carbide-tool tests, the information on Kennametal is the most complete, but

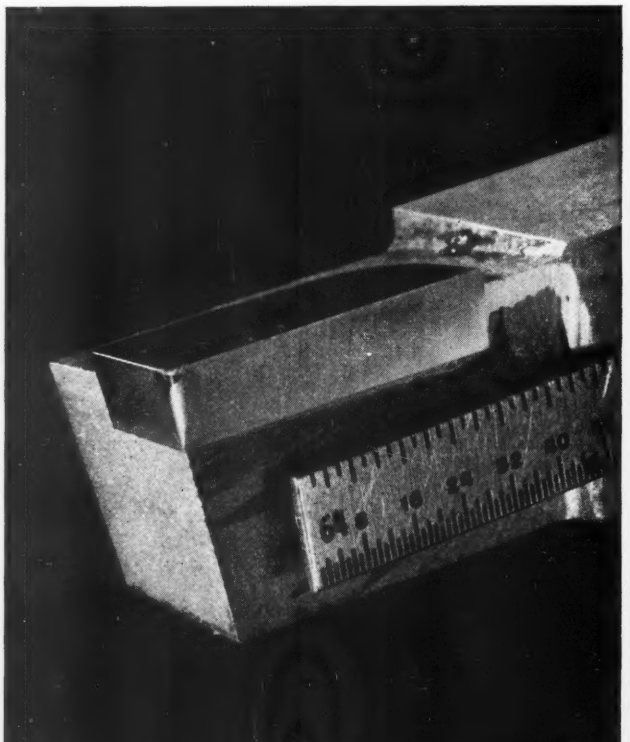


Fig. 6. Very little wear was exhibited by a cast-steel cutting grade of carbide (Kennametal K2S) in machining titanium under the same conditions as with the examples shown in Figs. 4 and 5

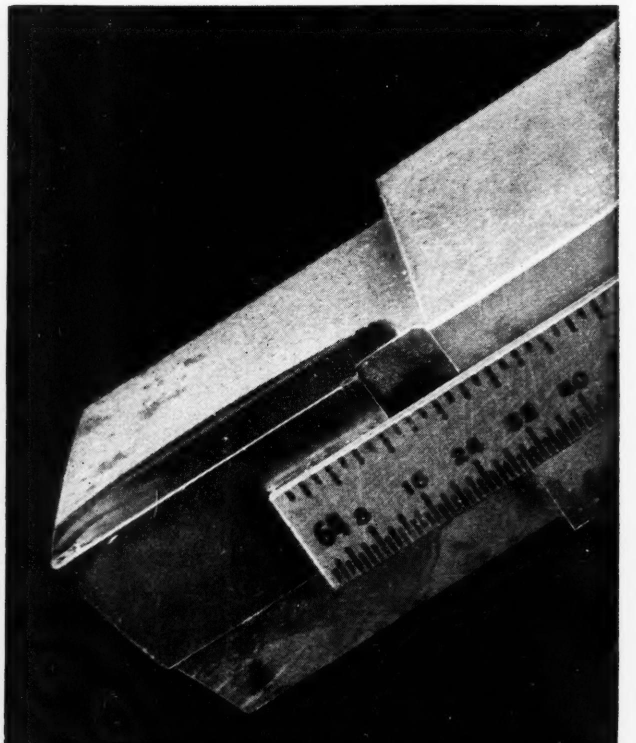


Fig. 7. The best results in machining titanium with a grade K6 carbide tool were obtained using a feed of 0.010 inch per revolution and a cutting speed of 120 feet per minute

its inclusion is not intended to imply any exclusive preference.

Styles AR 10, BR 10, and D 10, and modified versions of these tools were used, all having zero back rake, 6 degrees side rakes, zero side cutting-edge angle, 6 degrees end cutting-edge angle, and 6 degrees relief angle. The tool-life technique at this plant is to cut a predetermined quantity of metal (measured in square inches of machined surface) with each tool under identical conditions, and then study the wear land, or extent of breakdown. The four initial tests were made with a feed of 0.010 inch per revolution, a depth of cut of 0.030 inch, and a cutting speed of 36 feet per minute. Oil was used as a cutting fluid and 55 square inches of surface were machined. (This is equivalent to 5.5 cubic inches at 0.100 inch depth of cut).

Four grades of Kennametal were used in the tests, as follows: K3H, a steel-cutting grade; K6, a hard cast-iron grade; K2S, a cast-steel grade; and KM, a general-purpose grade. Both the K6 and K2S tools performed successfully, exhibiting practically no wear for the 55 square inches cut (see Figs. 4 and 6); the K3H tool showed medium wear (considered excessive); while the KM tool wore about the same (see Fig. 5).

On the basis of these tests, a grade K6 tool was again tried, this time with a feed of 0.020 inch per revolution, a depth of cut of 0.060 inch, and a cutting speed of 100 feet per minute. The tool was permitted to cut 95 square inches of surface, in which time the tool had cratered badly. With double the feed and almost three times the speed of the previous test, the machining rate was six times that of the earlier run in terms of square inches, and twelve times in terms of cubic inches, as the depth of cut was also doubled. The number of square inches machined increased from 55 to 95; therefore, the cutting time for the second test was approximately one-third that of the first test.

A finishing cut was then made, again using the K6 carbide tool. The feed was reduced to 0.010 inch per revolution and the depth of cut was made very shallow—only 0.0025 inch. The speed, however, was increased slightly—to 120 feet per minute—and 140 square inches of surface were machined. In this case, the wear was very slight (see Fig. 7), and the results were considered satisfactory. Finish in all tests but the heavy-feed one was good—about 100 micro-inches r.m.s.

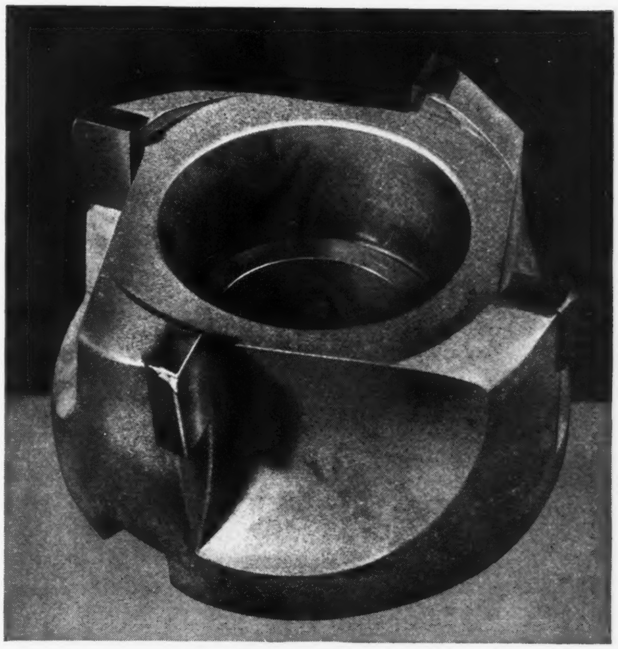


Fig. 8. This end-mill machined titanium at 46 feet per minute with a feed of 0.008 inch per tooth. After cutting very well for a short time, it broke down

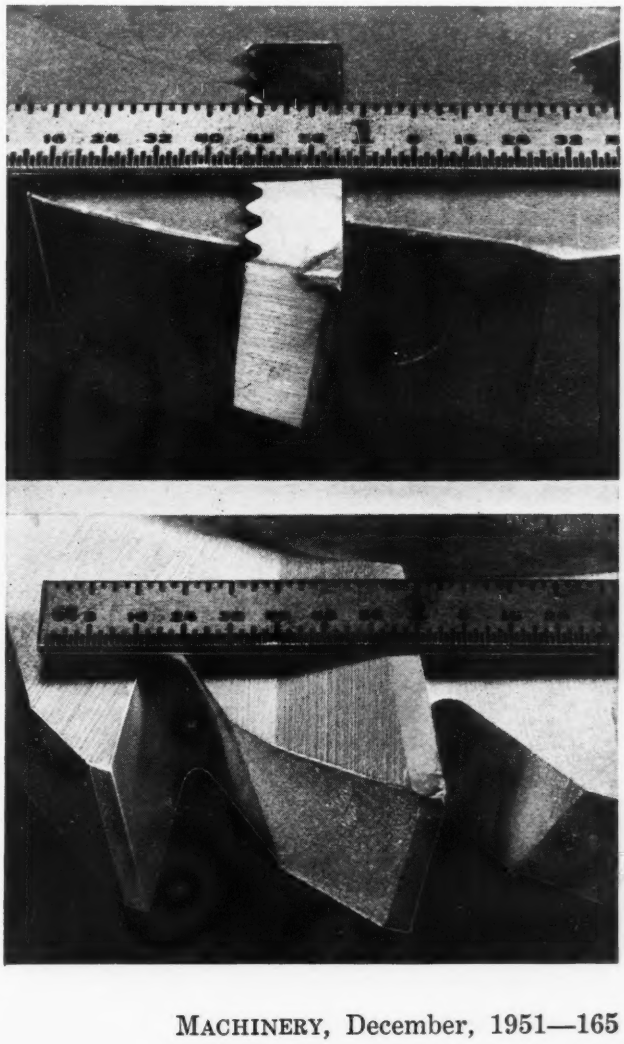


Fig. 9. Neither the plain high-speed steel side milling cutter shown above nor the chromium-plated cutter below was able to cut more than 2 square inches of titanium at 30 feet per minute without complete edge breakdown

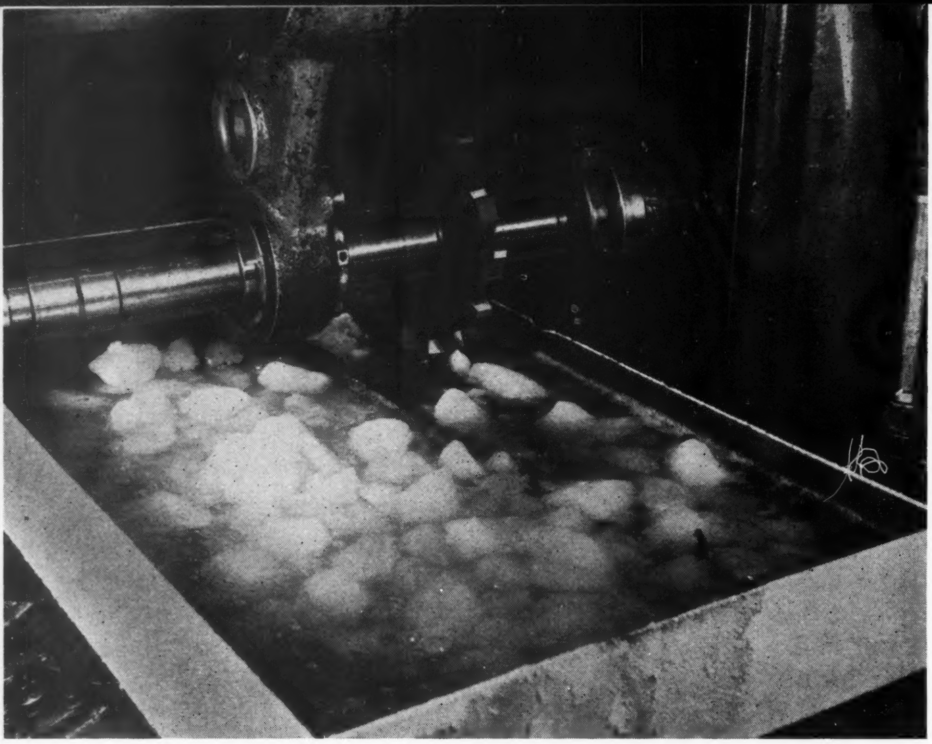


Fig. 10. A titanium test piece is submerged in dry ice and triethyl phosphate, resulting in a temperature of minus 100 degrees F., for carbide side milling tests

Milling tests were performed on a Kearney & Trecker No. 2 horizontal milling machine, using both carbide and high-speed steel cutters. Cutting speeds from 20 to 720 feet per minute and feeds from 0.004 to 0.016 inch per tooth were tried.

With a 4-inch diameter, four-tooth KM carbide tipped end-mill having a negative axial rake of 6 degrees, a positive radial rake of approximately 6 degrees, and a clearance angle of 6 1/2 degrees, tests were run under various conditions. At a speed of 21 feet per minute, cuts were taken with 0.006 and 0.008 inch feed per tooth, using lard oil as a cutting fluid. In both cases, the tool dulled rather quickly. A later test was made with the same cutter, using a speed of 46 feet per minute, a feed per tooth of 0.008 inch, and no cutting fluid. In this case, the tool cut well for a short time, after which extreme heating and rapid breakdown took place (see Fig. 8).

High-speed steel side milling cutters, plain and chromium-plated, were also tried at speeds of 27 to 31 feet per minute and feeds of 0.004 to 0.005 inch per tooth with poor results, as seen in Fig. 9. The chromium-plated tool broke down very quickly, while the plain cutter, having a slightly lower radial rake and less axial rake, lasted for 2 square inches before losing its edge.

Tests were then performed with a 6-inch diameter, six-tooth Carboloy-tipped side milling cutter having a 2 1/2-degree negative radial rake and a 6-degree negative axial rake. The titanium test piece was submerged in a bath of dry ice and triethyl phosphate (Fig. 10), resulting in a temperature of minus 100 degrees F. With this set-up, speeds of 31 to 69 feet per minute and feeds of 0.005 to 0.008 inch per tooth produced no tool wear. At 30 feet per minute and 0.016 inch per tooth, wear was slight. At 89 feet per minute and 0.013 inch per tooth, wear was also slight. In both cases, the finish was coarse.

Tests were also run at 118, 151, and 195 feet per minute, with feeds of 0.0045, 0.0015, and 0.008 inch per tooth, respectively, and the results were progressively poorer. Finally, a test was made at 720 feet per minute, in which the tool was badly damaged, as indicated in Fig. 11. Cutting time in these tests was not stated.

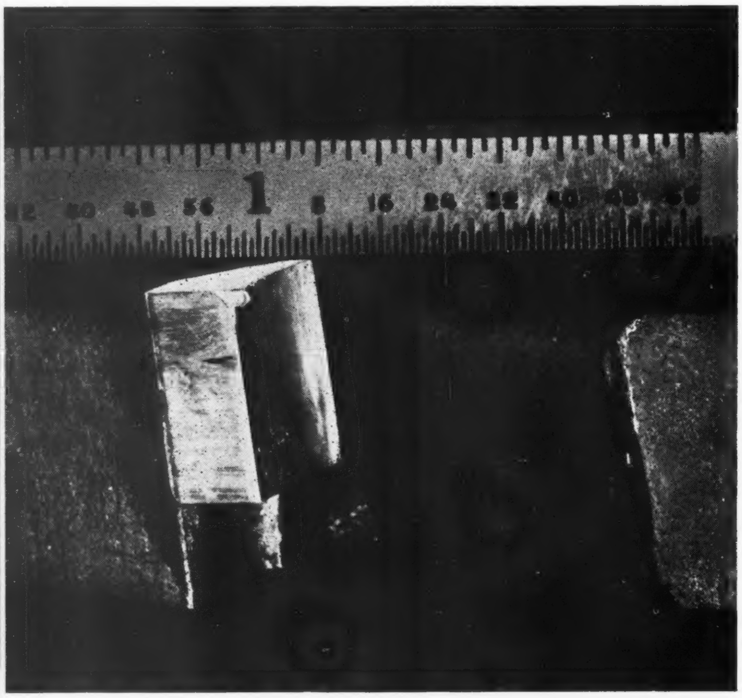


Fig. 11. Milling cutter tooth damaged in machining titanium at a cutting speed of 720 feet per minute. Best results were obtained with a speed of about 90 feet a minute

Cutting Speeds and Feeds for Slotting with End-Mills

By ROBERT COREY DEALE
Chief Engineer
The Sylvester Co.

ACCURATE basic standards for machining and handling operations are necessary if the rate of production in a machine shop is to be closely controlled. In a plant that manufactures a relatively small number of parts in large quantities, proper standards can be arrived at through experiment and time study. When a large number of different parts are made in small quantities, operating standards must be set from tables of basic data, since the length of the average run is so short that it is not possible to work out the best combination of feed and speed by experiment and then determine the time required to complete the piece through stop-watch observations. Even in the production shop, the time required to set a standard will be greatly reduced by the use of accurate standard data.

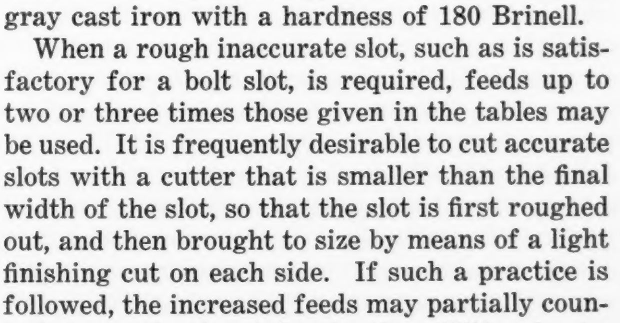
Little specific information is available on the use of end-mills, particularly for cutting accurate slots. The published data are usually confined to peripheral speeds for cutting various materials and general information as to tooth loads. It has been found that the recommended tooth loads cannot be used throughout the cutting range, since the load varies with the diameter of mill, the length of extension beyond the spindle or tool-holder, and the depth of slot to be cut. While an end-mill is occasionally used in a knee type horizontal milling machine with a dead-center support at its end, it is usually unsupported, and will deflect or even break if an excessive cutting load is used.

Shop experiments have been carried out to obtain the information necessary for the preparation of accurate tables of feeds and speeds. Blocks of AISI 1020 hot-rolled steel and gray cast iron were used for the purpose, and a series of slots machined in them to varying depths, using straight-shank, high-speed steel, commercial, high-spiral end-mills in a wide range of diameters. The first feeds used produced rough and inaccurate slots. These feeds were then reduced until smooth, accurate slots were produced, thereby obtaining definite information as to the maximum practicable feed for well supported work. The illustration shows the type of tool and tool-holder used and the type of cut taken. All work was performed on a modern vertical knee type milling machine.

After completion of the actual cutting operations, the data was analyzed and compared with results from other sources. Thus the effect of cutter diameter, depth of cut, and cutter projection was determined. The accompanying tables were then prepared, giving the cutting speeds and feeds to be used under various conditions. These tables are somewhat oversimplified in that a single cutting speed is used for all depths of cut with a given diameter of milling cutter, although, actually, the speed should vary with the chip load. The proper speed for the heaviest chip was given in order to have the variation on the safe side.

Table 1 is for use when cutting slots accurate to plus or minus 0.001 inch, with smooth sides, in AISI 1020 hot-rolled steel, using standard-length end-mills, while Table 2 is for use under the same conditions, but using long end-mills. Tables 3 and 4, similarly, are for use in cutting gray cast iron with a hardness of 180 Brinell.

When a rough inaccurate slot, such as is satisfactory for a bolt slot, is required, feeds up to two or three times those given in the tables may be used. It is frequently desirable to cut accurate slots with a cutter that is smaller than the final width of the slot, so that the slot is first roughed out, and then brought to size by means of a light finishing cut on each side. If such a practice is followed, the increased feeds may partially counterbalance the time taken by the additional cuts. The difficulty of maintaining cutters of exactly



Straight-shank, high-spiral, two-fluted end-mill used for milling slots in hot-rolled steel and gray cast iron to establish speeds and feeds given in the tables

Table 1. Cutting Speeds and Feeds for Slotting AISI 1020 Hot-Rolled Steel with Standard-Length High-Speed Steel End-Mills*

Depth of Cut, Inches	Cutter Diameter, Inches												
	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 1/2	2
	Length of Cutter Extension, Inches												
	3/8	7/16	1/2	9/16	9/16	13/16	1 5/16	1 5/16	1 1/2	1 1/2	1 5/8	1 5/8	1 5/8
	Cutting Speed, R.P.M.												
	1500	1500	1500	1500	1220	1000	815	670	545	445	365	302	247
	Feed, Inches per Minute												
1/32	1.00	4.00	8.75	8.75	8.75	10.50	8.75	6.50	5.12	4.25	3.5	3.0	2.50
1/16	0.43	1.50	4.00	7.25	8.75	10.50	8.75	6.50	5.12	4.25	3.5	3.0	2.50
1/8	0.25	0.62	1.75	3.00	5.12	7.25	7.25	6.50	5.12	4.25	3.5	3.0	2.50
1/4	....	0.31	0.75	1.50	2.50	3.50	3.00	5.12	5.12	4.25	3.5	3.0	2.50
1/2	....	....	....	....	1.25	1.50	1.25	2.00	2.50	4.25	3.5	3.0	2.50
3/4	....	....	....	....	....	....	0.87	1.50	1.75	2.50	3.5	3.0	2.50
1	....	....	....	....	....	....	....	....	1.25	1.75	3.0	2.5	2.00
1 1/4	....	....	....	....	....	....	....	....	....	....	2.5	2.0	1.75
1 1/2	....	....	....	....	....	....	....	....	....	....	...	3.0	2.50

*These cutters are of the two-flute, straight-shank, high-spiral type.

the diameter required makes such a procedure particularly desirable for cutting keyslots in small numbers of parts in a vertical knee type milling machine. It should be noted that when special-purpose keyway milling machines are employed, the keyways must be cut in a single pass with a cutter of the required diameter. When the cutter becomes dull, the worn part can be cut off and new teeth ground on the end.

It has not yet been possible to extend the experimental work to cover the machining of slots in other materials than those mentioned. When other materials are to be cut, both the cutting speed and the feed must be varied. For a given tooth load, the feed per minute varies directly with the cutting speed, in revolutions per minute. Also, the tooth load varies according to the material being cut.

Table 2. Cutting Speeds and Feeds for Slotting AISI 1020 Hot-Rolled Steel with Long High-Speed Steel End-Mills*

Depth of Cut, Inches	Cutter Diameter, Inches								
	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/4
	Length of Cutter Extension, Inches								
	1 1/2	1 3/4	1 3/4	2 1/4	2 3/4	3 3/8	4	5	5
	Cutting Speed, R.P.M.								
	1500	1500	1220	1000	815	670	545	445	365
	Feed, Inches per Minute								
1/32	2.50	4.25	7.25	8.75	7.25	6.50	5.12	4.25	3.50
1/16	0.87	1.75	3.00	5.12	7.25	6.50	5.12	4.25	3.50
1/8	0.43	0.75	1.00	2.00	3.00	3.50	4.25	4.25	3.50
1/4	....	0.25	0.43	0.50	1.25	1.50	1.75	1.75	3.50
1/2	....	....	....	0.31	0.50	0.50	0.62	0.62	1.25
3/4	....	....	....	0.25	0.25	0.31	0.43	0.37	0.75
1	....	....	....	....	....	....	0.25	0.25	0.50
1 1/4	....	....	....	....	....	....	....	0.25	0.37

*These cutters are of the two-flute, straight-shank, high-spiral type.

Table 3. Cutting Speeds and Feeds for Slotting 180 Brinell Gray Cast Iron with Standard-Length High-Speed Steel End-Mills*

Depth of Cut, Inches	Cutter Diameter, Inches												
	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 1/2	2
	Length of Cutter Extension, Inches												
	3/8	7/16	1/2	9/16	9/16	13/16	1 5/16	1 5/16	1 1/2	1 1/2	1 5/8	1 5/8	1 5/8
	Cutting Speed, R.P.M.												
	1500	1500	1500	1500	1220	1000	815	670	545	445	365	302	247
	Feed, Inches per Minute												
1/32	0.75	3.00	7.50	10.00	8.75	6.5	4.25	3.50	3.00	2.50	2.5	1.75	1.25
1/16	0.25	1.25	3.00	5.00	8.75	6.5	4.25	3.50	3.00	2.50	2.5	1.75	1.25
1/8	....	0.50	1.25	2.00	4.00	6.0	4.25	3.50	3.00	2.50	2.5	1.75	1.25
1/4	....	0.25	0.50	1.00	1.50	2.5	2.00	3.50	3.00	2.50	2.5	1.75	1.25
1/2	....	....	0.25	0.50	1.00	1.5	0.87	1.50	2.00	2.50	2.5	1.75	1.25
3/4	....	....	....	....	....	1.0	0.50	1.00	1.25	2.00	2.5	1.75	1.25
1	....	....	....	....	....	...	0.50	0.87	1.00	1.25	2.5	1.75	1.25
1 1/4	....	....	....	....	....	...	....	0.75	0.75	1.25	2.5	1.75	1.25
1 1/2	....	....	....	....	....	...	....	....	....	....	2.5	1.75	1.25

*These cutters are of the two-flute, straight-shank, high-spiral type.

For harder steels, it is necessary to reduce the tooth load, since the pressure of the cut on the tool under otherwise constant conditions tends to increase as the steel becomes harder. On the other hand, it may be possible to increase the tooth load materially when cutting softer materials, such as soft iron, brass, aluminum, etc. In this connection, it should be noted that the feed given in the tables has been limited to 0.005 inch per tooth, even when the strength of the tool allows a greater feed, in order that a smooth cut may be secured. The "Manual on Cutting of Metals," published by the American Society of Mechanical Engineers, shows tables that may be used as a guide in determining the relative machinability and cutting resistance of various commonly used materials.

It was previously mentioned that a single cut-

Table 4. Cutting Speeds and Feeds for Slotting 180 Brinell Gray Cast Iron with Long High-Speed Steel End-Mills*

Depth of Cut, Inches	Cutter Diameter, Inches								
	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/4
	Length of Cutter Extension, Inches								
	1 1/2	1 3/4	1 3/4	2 1/4	2 3/4	3 3/8	4	5	5
	Cutting Speed, R.P.M.								
	1220	1000	815	670	445	365	302	247	247
	Feed, Inches per Minute								
1/32	1.50	2.50	5.12	6.50	4.25	3.50	3.00	2.50	2.50
1/16	0.50	1.00	1.75	3.50	4.25	3.50	3.00	2.50	2.50
1/8	0.25	0.25	0.75	1.25	1.75	2.00	3.00	2.50	2.50
1/4	....	....	0.25	0.50	0.62	0.87	1.00	1.25	2.50
1/2	....	....	....	....	0.25	0.31	0.43	0.43	1.00
3/4	....	....	....	....	....	0.25	0.25	0.25	0.62
1	....	....	....	....	....	....	....	....	0.43
1 1/4	....	....	....	....	....	....	....	....	0.31

*These cutters are of the two-flute, straight-shank, high-spiral type.

ting speed was given in the tables for each diameter of end-mill in spite of the fact that experimental data indicate that cutting speeds should decrease as the chip thickness is increased if the same tool life is to be obtained. The necessary decrease in speed is less proportionately than the increase in feed, so that the most effective rate of removing metal is to use a feed and depth of cut as great as the work, machine, and tool will permit, and a speed appropriate for the cut.

Experimental work under normal shop conditions is necessary in order to make certain that machines and tools are used in the most effective manner. It is recognized that such tables as are given here must be modified at times to allow for machine condition, work rigidity, methods of holding work, and the like. However, it is highly necessary to have basic data available which apply to good equipment, properly used, leaving as little as possible to judgment. When no such data are available, the variation between the rates set by various rate setters and the feeds and speeds used by different machine operators is certain to be far too great.

Meeting of National Tool and Die Manufacturers

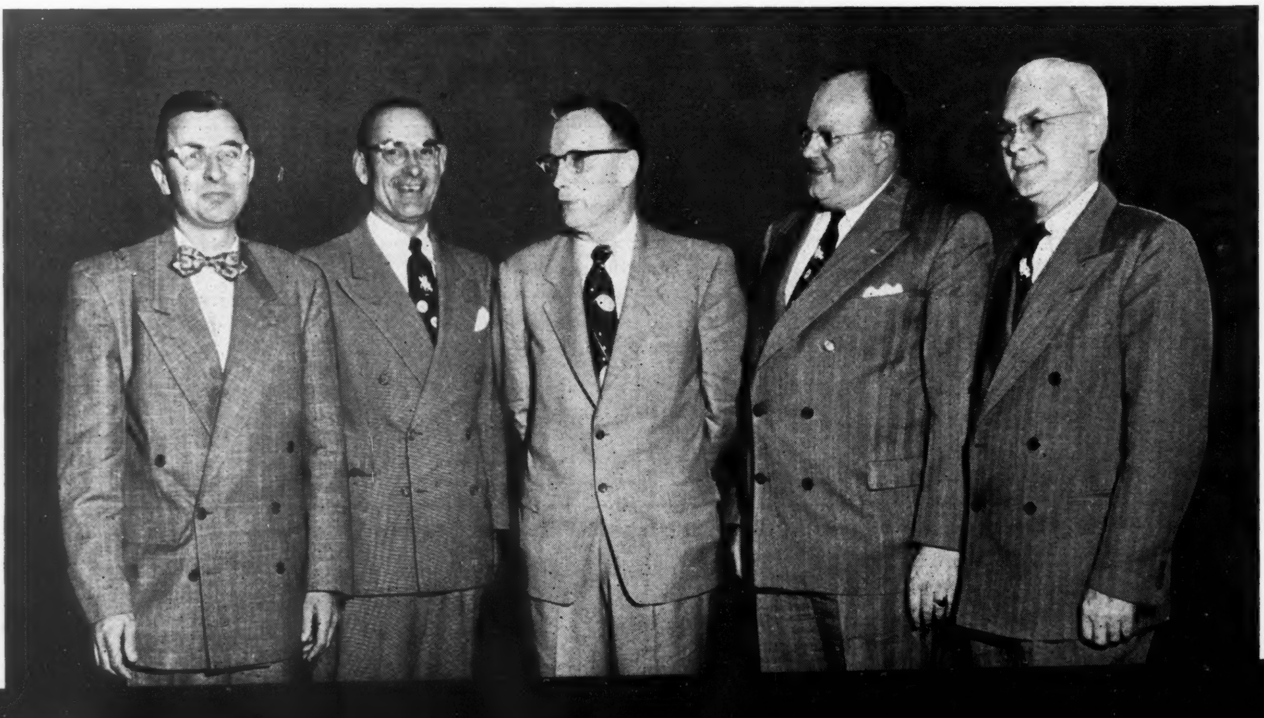
TOOL and die executives from tooling centers throughout the country concentrated on labor problems at the three-day annual meeting of the National Tool and Die Manufacturers Association recently held in St. Louis. The executive secretary, George S. Eaton, stated that according to a survey just made, the scarcity of labor in the industry is now countrywide. Programs for training men to do precise tool and die work were recognized as an important need. A special panel headed by DeForest Pratt, director of training of the Cincinnati Milling Machine Co., brought out a number of ideas in this regard.

Colonel Lewis F. Kosch, chief of the Manpower Division, Selective Service, informed the delegates that the importance of the tool and die industry is now recognized and local boards have been instructed to give every consideration to the industry. Vigorous enforcement of present wage stabilization regulations is necessary if labor migration from plant to plant is to be kept at a minimum, Eugene B. Schwartz, labor relations attorney of Cleveland, told the delegates.

Plaques were awarded by the newly elected president, Randolph H. Cope, vice-president of Bunell Machine & Tool Co., Cleveland, to Herbert F. Jahn, of B. Jahn Mfg. Co., New Britain, Conn., retiring president; Philip R. Marsilius, of Producto Machine Co., Bridgeport, Conn., the tool and die industry's consultant to the NPA; and Robert C. Renner, of East Dayton Tool & Die Co., Dayton, Ohio, the industry's consultant to the WSB.

Other new officers elected besides Mr. Cope, were: First vice-president, Alfred Reinke, president of Gus Reinke Machinery & Tool Co., Hillside, N. J.; second vice-president, Herbert C. Murrer, president of the Murrer Tool Co., Cincinnati, Ohio; secretary, Joseph N. Huser, president of the B & H Specialty Co., Indianapolis, Ind.; and treasurer, Herbert Harig, vice-president of the Harig Mfg. Co., Chicago, Ill.

New officers elected at the annual meeting of the National Tool and Die Manufacturers Association. (Left to Right) Herbert Harig, treasurer; Herbert C. Murrer, second vice-president; Randolph H. Cope, president; Alfred Reinke, first vice-president; and Joseph N. Huser, secretary



Designing Dies for Postforming Thermosetting Laminates

Fifth of a Series of Articles Dealing with the Forming and Drawing of Thermosetting Laminated Plastics

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North American Aviation, Inc.
Los Angeles, Calif.

PREVIOUS articles in this series, the last of which appeared in September, 1951, MACHINERY, have covered some of the physical characteristics of fully cured, "C" stage, thermosetting laminated plastics, as well as production techniques applied to this material with the postforming process. This article will cover the design and construction of the dies used.

Note: The Postforming Process is covered by United States and foreign patents and pending applications are assigned to North American Aviation, Inc.

Heat formable laminates lend themselves admirably to low-pressure shaping methods. Because of the necessity of forming or drawing thermoset laminates in one continuous operation, special dies and tools are required for the process. When properly treated, the plasticity of these materials offers little resistance to deforming forces, and in view of this fact, multiple acting dies have been designed to facilitate free operation of the die elements in any desired plane. This results in low-cost production.

Fig. 1. Various types of hand-operated dies for postforming thermosetting laminated plastics

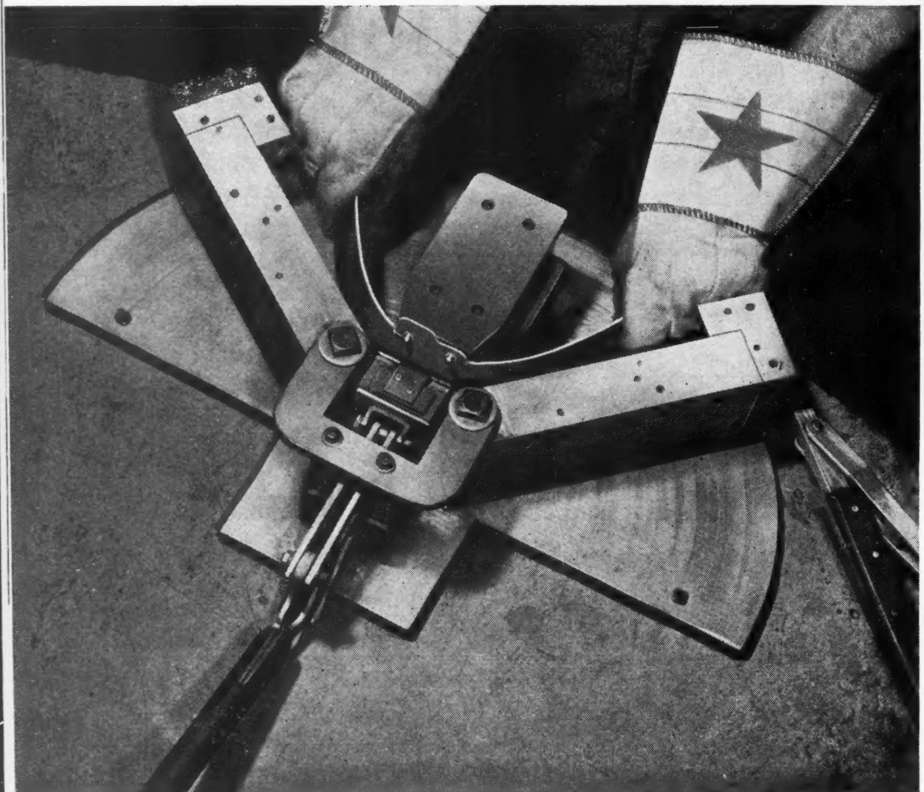


Fig. 2. Locating a heated plastic blank on tooling pins in a hand-operated wing type die

A desirable feature of the postforming process is that it does not require expensive and time-consuming tools, such as accurately machined tool-steel dies and heavy supplemental press equipment employed in metal-working plants. As mentioned, the forming pressures required to shape laminated sheet stock are relatively low. They range from 10 to 100 pounds per square inch, depending upon the depth of draw, thickness of the material, and shape of the part to be formed. For this purpose, a plentiful source of inexpensive construction material is available. The choice of material is, of course, governed by the type of work to be handled.

Wooden dies are satisfactory for parts of simple contour that require a minimum amount of bending. Wood is suitable, and especially adaptable, for the construction of prototype and experimental dies which must be made quickly and at low cost. Frequently when production schedules are limited to 1000 parts or less, wooden dies will give adequate service with little or no maintenance work. For more difficult formed parts or large production requirements, dies

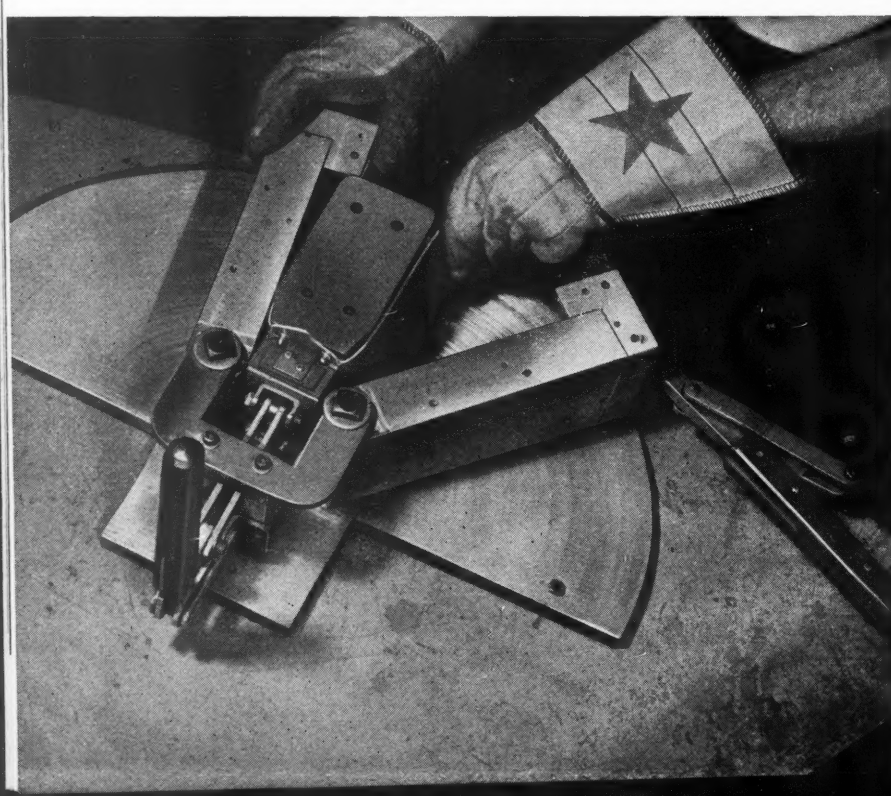
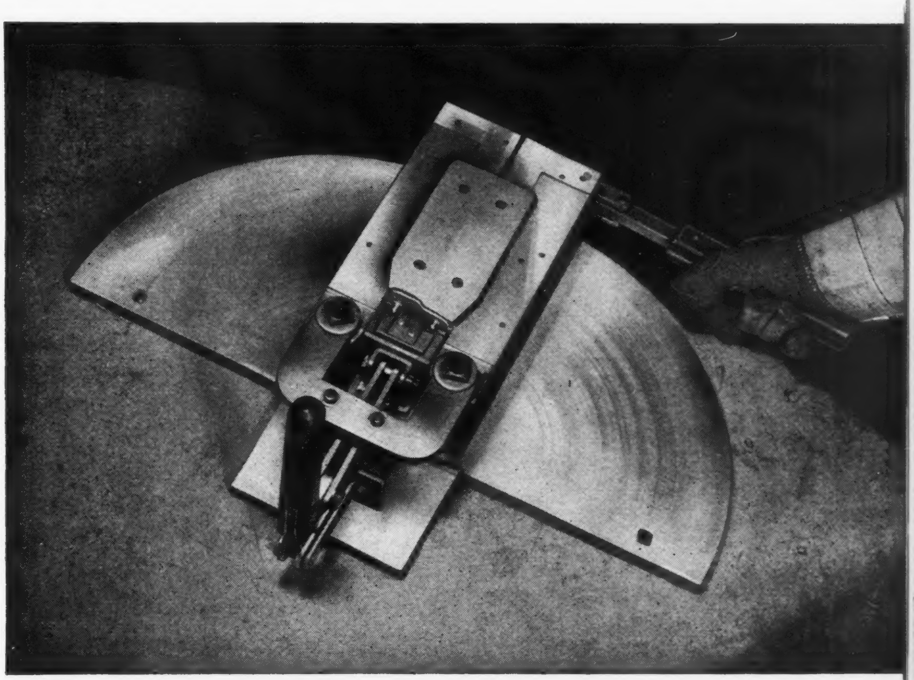


Fig. 3. Closing the die shown in Fig. 2 by operating toggle clamp in foreground and pushing the wing members together

Fig. 4. The hand-operated die shown in Fig. 3 is locked in this position for the cooling period



built of more durable materials are recommended. Constant application of heat and pressure will ultimately warp a wooden die, resulting in the opening of glued joints and in loss of shape.

Another useful material is Masonite, which is widely used for such elements as faceplates and other parts of the die. Like wood, Masonite can be utilized effectively for simple operating dies. However, this material is somewhat sensitive to continuous application of heat, and should be used judiciously in pressure forming members where dimensional stability and tolerances are critical.

For moderately long service, cast phenolic dies hold up very well. Dies utilizing casting resin are relatively inexpensive, since they are easily and quickly made, and require very little maintenance. The casting resin is supplied in liquid form, which when catalyzed and blended with a suitable filler, can be poured and will harden in almost any conceivable shape. The purpose of the filler is to add toughness and resistance to shrinkage—always a source of trouble with casting components. Unless curing or hardening is accelerated with heat, casting resin takes hours and sometimes days to set under ordinary room temperatures. Oven curing will accomplish the same result in a matter of minutes.

The methods employed for pouring casting resin are similar to those used by foundries when pouring Kirksite, cast aluminum, etc. A pattern

Fig. 5. Removing the ammunition ejection chute, which has been completely formed in the Kirksite die shown in Figs. 2 to 4

Fig. 6. Forming a section of a laminated-plastic ammunition chute assembly in a single-stage press die made almost exclusively of Masonite

is required, from which impressions are taken to produce pouring molds. The resin is poured cold and hardened by heating at a temperature of approximately 180 degrees F. for a period of from fifteen minutes to an hour. Castings having considerable mass will take several hours to cure.

Occasionally, cast plastic dies crack under adverse conditions. In so far as steady pressure is concerned, the plastic die members will withstand loads of 20,000 to 40,000 pounds per square inch. Impact loads are to be avoided. Also, dies of this type should not be used in continuous operation, because too much heat tends to produce a slight shrinkage, which may cause cracks to form in the die surfaces. Although cracks may be repaired or filled with the same resinous compound as is used in making the dies, it is preferable to replace the dies or rotate them occasionally for long production schedules.

Often it is advisable to resort to a metallic die for certain types of postforming work. From a production point of view, a die made of Kirksite, aluminum, brass, or cast iron has some definite advantages over any of the materials previously discussed. The non-metallic materials, of course, are poor conductors of heat; hence, accumulation of heat within the die eventually reduces its effectiveness. It will be remembered that during the fixation period the part must cool to substantially 180 degrees F. before it can be safely discharged from the die and another part formed. Since the metal die is a better conductor of heat, cooling delays are less critical. In addition, metal dies can be cored for cooling systems or insulated, whichever is needed.

Unless non-metallic dies are rotated—a recommended practice, especially if production quan-

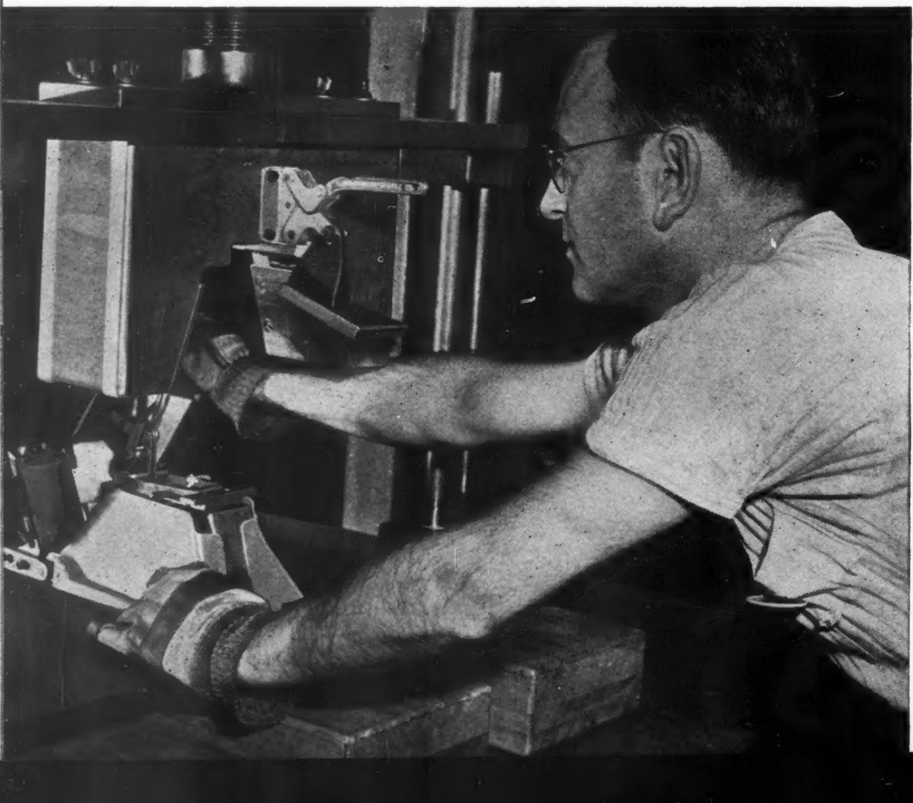


Fig. 7. This two-stage press die, designed to produce an ammunition ejection chute similar to that shown in Fig. 5, is operated semi-automatically

tities are involved—periodic work stoppage will be necessary to allow the die to cool. Although work stoppage can be minimized by utilizing the rotation system or other methods, the metal die, being more durable and less affected by "heat lock," offers better possibilities for constant service than the non-metallic die.

No definite rule can be given that will enable the operator to make a quick decision as to which type of die is preferable. This decision rests with the individual, who, after all the facts concerning production requirements, costs, delivery schedules, facilities, and the exact nature of the product are carefully considered, is then in a better position to judge.

For purposes of utility and economy, as well as to facilitate die construction, postforming dies are built up of several different types of material. The faceplates, which make up the upper and lower base of the die, usually consist of Masonite sheet. Attached to the faceplate are matched shaping members, which may be molded from cast plastic or Kirksite.

On some occasions, it may be advisable to employ unlike materials for the male and female dies. In that case, the best practice is to use cast plastic for the moving member and Kirksite for the stationary member. Also, Masonite and cast plastic or Masonite and Kirksite can be used effectively together as stated. Other component parts can be constructed of wood, Masonite, light alloy, or steel.

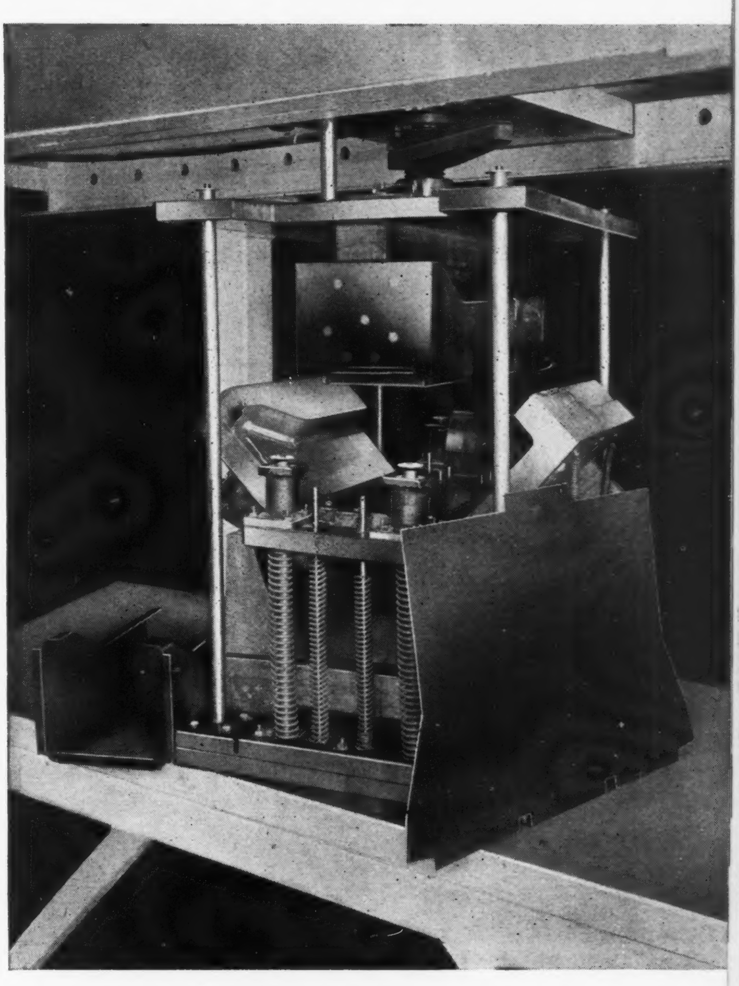


Fig. 8. An automatic, two-stage press die employed for forming thermosetting laminated-plastic glove compartments

Various Types of Dies Designed for Postforming Operations

The variations in design of postforming dies are many, and each part to be formed is likely to require some new feature or combination of features in production procedures. The type of forming die to be used is determined by the design of the part, the properties of the material to be processed, and the number of parts that are required.

In so far as the design of the part is concerned, full consideration must be given to the general type of die that will adequately satisfy the specified requirements. Relatively simple shapes possessing straight bends and generous curves can be suitably processed by the use of single-stage dies. More complicated parts, with compound curves, deep drawn sections, or closed angles, usually necessitate the use of semi-multiple or multiple-stage dies.

As for material properties, these must be considered in choosing between a bench working die or a press-operated die. The depth of draw or degree of bend is primarily dependent upon material thickness and forming pressure. With thin material, the pressure required is small; hence bench dies serve very well. Thicker pieces take more pressure to deform, and therefore press-operated dies are called for.

Finally, the preliminary design should be viewed in the light of production schedules. Since the average forming cycle is approximately five minutes per part, the total output per die can be estimated for an eight-hour shift. On the basis of the daily production expected, and assuming that more than one die is required to meet schedules, the designer may find it expedient to resort to a highly productive type of die. Under these conditions, a multiple-cavity die capable of producing a number of parts in the same operating cycle offers possibilities for speeding up production and, at the same time, reducing manufacturing costs.

Hand-operated dies are especially useful for the production of small parts. Fig. 1 illustrates several different types of bench forming dies. In the foreground is shown a rotating table upon which is seen an assortment of hand-operated dies. These dies are constructed of inexpensive

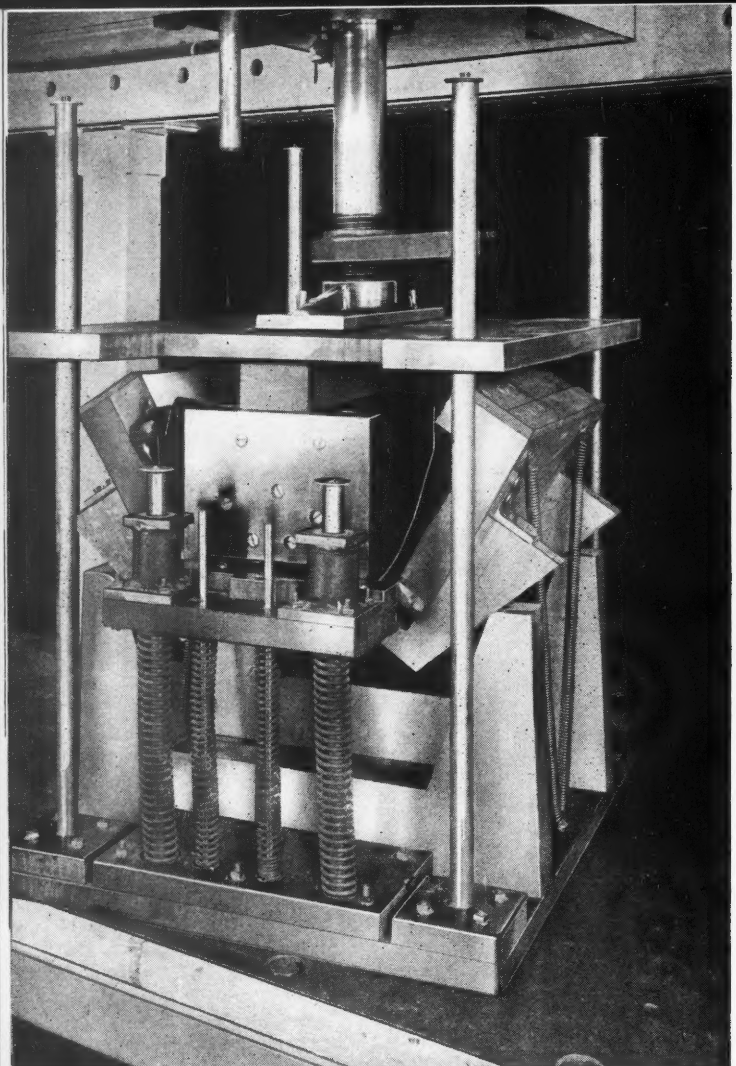


Fig. 9. The two-stage die illustrated in Fig. 8 is shown here with the blank folded around the core

material, such as wood, Masonite, Kirksite, and laminated paper or fabric base plastic stock.

It will be noticed that the only pressure applied to these dies is obtained by means of toggle clamps arranged in various positions. The operator rotates the table and alternately forms and removes parts as each die reaches the loading position in front of an oven at the right in which the work is heated for forming. Bench dies not in use are stored in compartments beneath the revolving table. In the background are three pneumatic presses used for more complicated multiple-acting dies and heavier materials. More will be said about such press dies later.

The wing type bench die shown in Figs. 2 to 5, inclusive, illustrates the principal operating features of this type of tool. Fig. 2 shows the first step, which consists of locating the heated blank on tooling pins. Next the operator closes the die by pulling the toggle clamp shown in the foreground of Fig. 3, and pushing the two wing members together. In the third step, Fig. 4, the die is locked in position for the fixation period of cooling, after which the die is opened (Fig. 5) and the formed part—an ammunition ejection chute—is removed. The material used in this die is Kirksite.

Press dies are used for forming shapes requiring more positive pressure—to impress beads, form closed and open flanges, and produce drawn objects having simple or compound curvatures. Fig. 6 illustrates a typical single-stage press die in which a section of an ammunition chute assembly is formed. The completed parts at the left of the die are pieces on which curved and straight flanges, as well as a diagonal bead, have been formed. The material used in this die is almost exclusively Masonite.

A console part is formed in another type of single-stage die. In this die, Masonite is used for the faceplates, cast plastics for the upper female member, and wood with some Masonite for the lower male member.

A typical semi-automatic, two-stage die is shown in Fig. 7. This die is designed to produce an ejection chute similar to the one made in the wing type bench die seen in Fig. 5. The completed part is shown resting on the stationary core. In operation, this die works about the same as the wing type bench die, except that positive pressure is exerted by the cam action

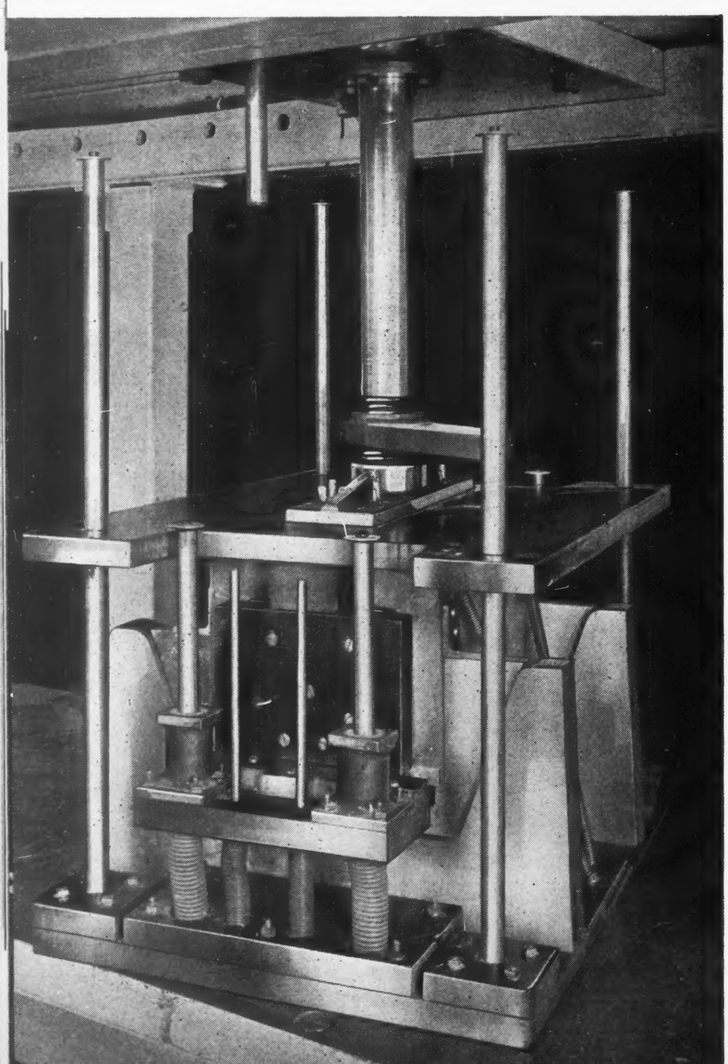


Fig. 10. When the bottom stop is reached by the automatic die shown in Fig. 9, the upper and vertical flanges of a plastic glove compartment have been formed, completing the part

of the upper closing member shown in the open position directly above the stationary core.

As the wing members are folded downward, pressing the heated blank around the core, the closing member is lowered until the sloping sides engage the matching sides of the wing plates. This forces the wing plates against the core, and thus the curved flanges are formed. The closing flanges on the front of the chute are formed by means of the toggle clamp attachment shown on the face of the closing or cam acting member.

An automatic two-stage die is illustrated in Fig. 8, together with the blank and formed part. The part produced is a glove compartment. The operator places the blank on the locating pins and brings the plunger or core into contact with the spring-loaded floating base to which are attached two folding plates. At this stage, the plunger compresses the blank, thus turning up the lower horizontal flange. As the plunger, together with the floating plate, continues downward, Fig. 9, the wing plate contacts several cam actuating members located on the sides of the die and folds the blank around the core. By the time the bottom stop is reached, Fig. 10, the upper flanges and the vertical flanges are also formed. This die is constructed largely of Masonite and wood.

* * *

Device for Measuring Angles Up to 180 Degrees

A handy mechanic's protractor designed for "on the job" measuring of angles up to 180 degrees has been placed on the market by the Interstate Sales Co., 123 E. 18th St., New York 3, N. Y. The device should prove useful to engineers, construction men, inspectors, sheet-metal workers, welders, and others. Three readings are obtained simultaneously with one setting—outside angle; adjacent inside angle; and equivalent pitch in inches per foot.

To measure certain inaccessible acute angles, a straightedge may be used to extend one side of the angle. When the protractor itself cannot be used, the angle may be taken with a carpenter's bevel and the angle of the bevel measured with the protractor. Readings accurate to a fraction of a degree are facilitated by locating the calibrations at the extreme of the protractor's radius.

The Vinylite plastic rigid sheet of which the device is made has exceptional dimensional stability and is resistant to water, oil, grease, and most chemicals. It can be easily cleaned with a damp cloth. A lamination of the plastic prevents the calibrations from wearing off.

Measuring Hardness of Electrodeposits at Elevated Temperatures

A new microhardness tester for measuring the hardness of electrodeposits at elevated temperatures has been developed by the National Bureau of Standards. The device utilizes the diamond indentation method, but because of the relative thinness of electroplated coatings and their softness at high temperatures, it has been especially designed to make indentations of microscopic depth under very low loads.

The principal units of the apparatus are a Vickers diamond indenter, mounted on a shaft of fused silica; a mechanical device for raising and lowering the indenter; an electric furnace for heating the specimen; and a micrometer device for positioning the specimen under the indenter. Loading mechanism, indenter, and furnace are all enclosed in one compact, self-contained unit.

Before using the apparatus, it is evacuated and flushed out with hydrogen. An inert gas is then injected under pressure. Six specimens are heated at a time in a muffle made of two tubes—one horizontal and one vertical—which intersect to form a cross. The specimens are moved along the horizontal tube of the muffle until one of them comes to rest on an anvil at the lower part of the vertical tube. The indenter is then lowered through the upper part of the vertical tube to make a pyramidal impression on the specimen resting on the anvil.

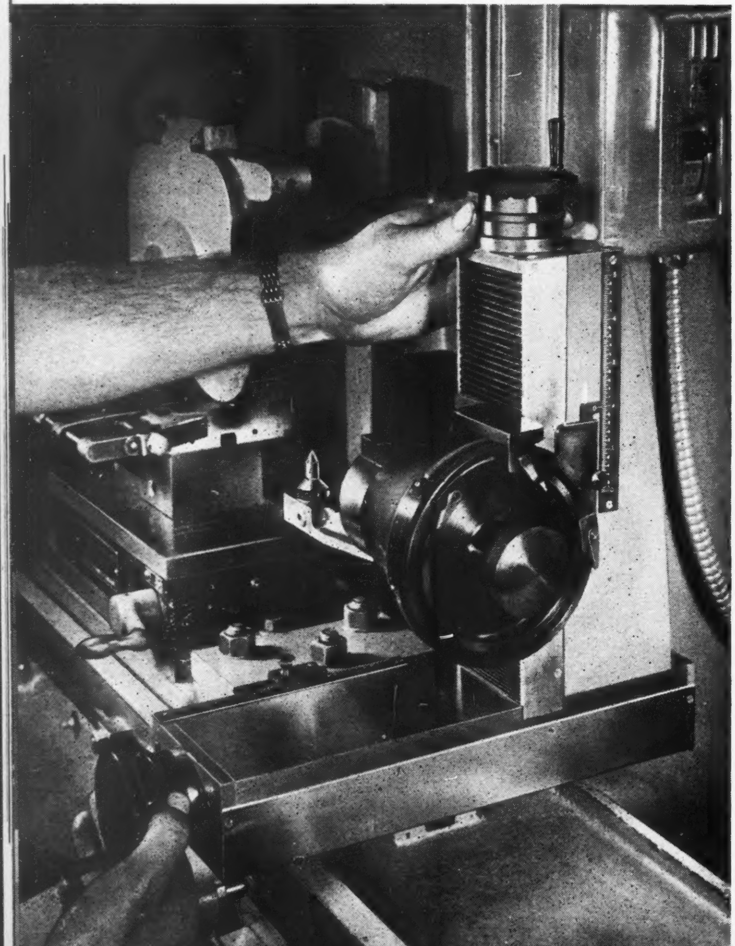
Because the indentations are microscopic in size, they are difficult to locate in the small field of a microscope for measuring. To facilitate this, a fitting has been designed to hold the carriage in a definite position on the stage of a traveling microscope. By setting the microscope stage at the same reading as that on the micrometer when the indentation was made, the impression is easily brought into view.

* * *

Special Machinery Film

An industrial film demonstrating the application of special machinery to the production of two types of automotive transmission parts has been produced by Greenlee Bros. & Co. The film follows the progress of the work-piece through the stations of five huge transfer machines, and shows unusual designs of fixtures for tilting and rotating the work during the machining. Arrangements for showing this eighteen-minute 16-millimeter sound film can be made by writing to the Special Machinery Sales Department, Greenlee Bros. & Co., Rockford, Ill.

Fig. 1. In making the initial setting before dressing a wheel, the dresser diamond is replaced with a dial indicator to establish the relationship of the dresser spindle center with a pilot hole in the work



Wheel Dressing in Insures Accurate

An Ingenious Method of Dressing the Wheel for Form-Grinding Punches and Dies that Employs the Same Principles as are Used in Making Settings for Jig Boring or Jig Grinding

ONE of the most difficult problems encountered in form-grinding precision punches and dies of irregular shape is to dress the grinding wheel to the desired contour and then transfer the form to the work in exactly the proper location. Both of these operations must be done with a high degree of accuracy. After redressing a worn wheel following a form-grinding operation, it must be returned to exactly the same position relative to the work, so that inaccuracies will not be introduced in the position of the form. Sometimes a finishing wheel is to be dressed with the same form as was used in a rough-grinding wheel, and here, again, it is difficult to relocate the form accurately.

These and other problems in form-grinding have been solved through a new wheel-dressing method developed by Yarema Brothers Tool & Die Co., Allentown, Pa. In this system, the grinding wheel dresser is set by the coordinate method employed in setting up jig boring and jig grinding machines.

The principal feature of this dresser is the facility with which it can be set to the locations of various components of a form. This is accomplished by working from reference surfaces or holes, with the form dimensions given in rectangular coordinates. The center locations of all radii must be shown on the drawing, of course, as must the intersections of angles or any other critical points. A drawing of a typical die form dimensioned in this manner is shown in Fig. 5.

The wheel-dresser head contains a spindle, on one end of which is a control knob *A*, Fig. 6, for rotating a yoke *B* on which the diamond-holder is mounted in a dovetailed cross-slide *C*. The knob controls both the radial and the lateral movements of the cross-slide. When the radial stops *D* are in contact with a bumper block *E*, further radial pressure causes a movement of the diamond-holder cross-slide in a preset an-

Fig. 2. This grinding wheel dresser is set up by means of rectangular coordinates for dressing radii and tangent angles in proper location with respect to the work

Line with Work Form-Grinding

By
ALEXANDER YAREMA
Yarema Brothers Tool & Die Co.
Allentown, Pa.

gular direction. By means of the knurled rim of the graduated wheel, the diamond can be set to the radial position determined by the stop and held there until the slide is returned to center. In this way, a radius and two tangent angles can be dressed in a grinding wheel in almost one continuous movement.

The spindle wheel has 360 degrees of graduations, so that concave radii tangent to angles can be dressed in the same manner when the yoke is reversed. A wheel lock is provided in the bumper block to facilitate angle dressing, and a vernier graduated in increments of 5 minutes is located on the spindle housing.

The diamond *F* is held in a shouldered bushing, and a standard dimension of 1.125 inches from the shoulder to the point is maintained for setting-up purposes. By using several bushings, worn diamonds can be employed for roughing and the newer ones inserted for finish-dressing, the height settings being easily made on a surface plate. The distance between the top of the yoke and a flat on the slide determines the size of a radius, and can be quickly set with a depth micrometer, as seen in Fig. 3.

To locate the center line of the fixture for dressing the various sections of a form in a wheel, the entire head assembly of the dresser moves horizontally and vertically on dovetail ways. Each movement is controlled by a hardened and ground lead-screw having V-threads operating in adjustable bronze nuts Provision is made for taking up end play under the hollow control knobs *G* and *H*, Fig. 6. The dials on these knobs are graduated in five ten-thousandths of an inch. Rough setting scales and locking devices are also provided on this dresser, as well as a bellows for preventing the entry of grit and dust.

The dresser is bolted directly to the machine table; however, it would be advantageous to have

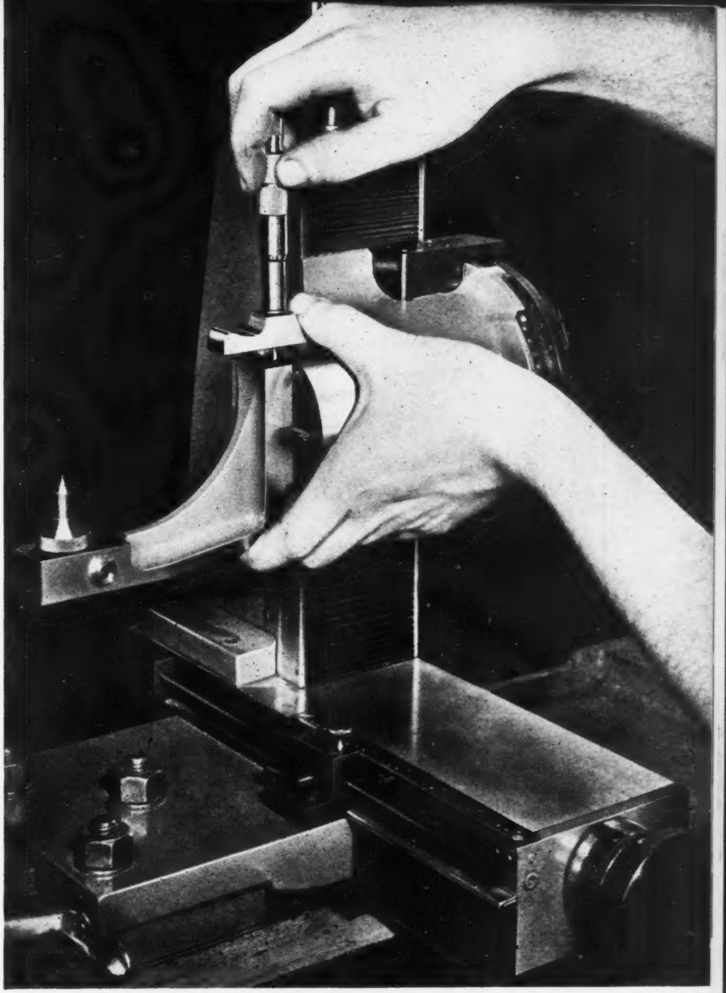


Fig. 3. The size of a radius to be dressed in a grinding wheel is determined by measuring the distance from a flat on the cross-slide of the dresser to the top of the yoke, as shown

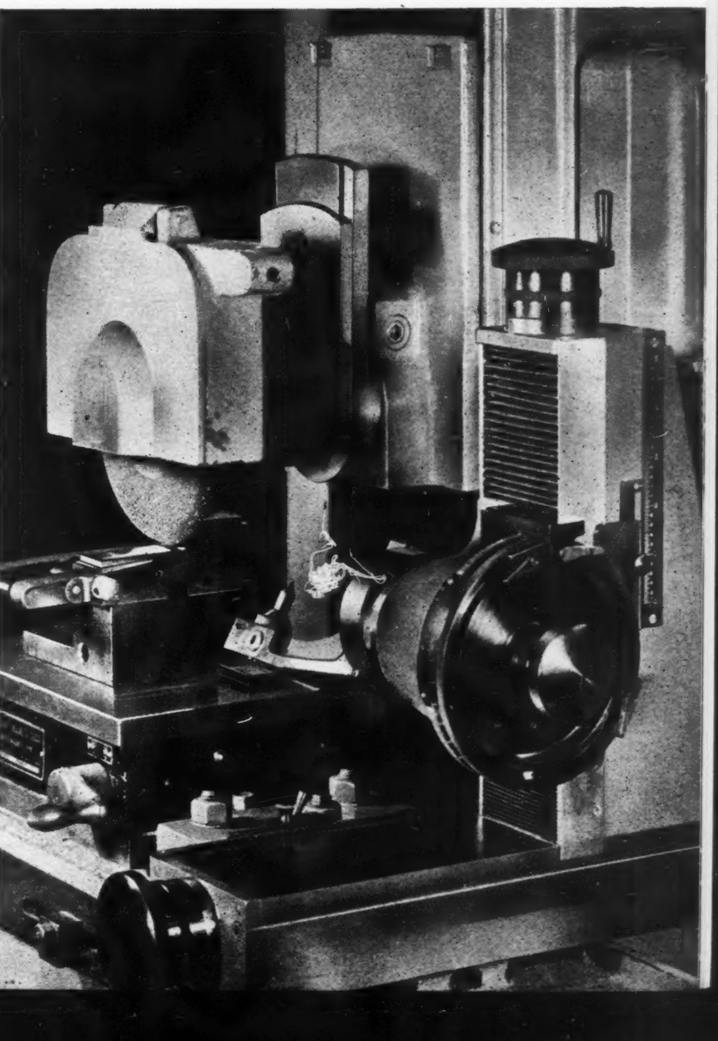


Fig. 4. Form-grinding a section of a die-block after the wheel has been dressed in line with the work by the rectangular coordinate method

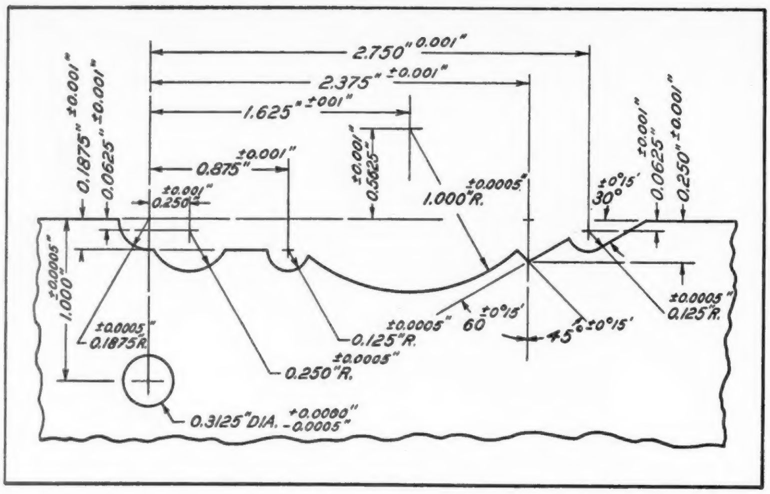


Fig. 5. Example of the rectangular coordinate method of dimensioning a typical die form

a suitable holder permanently mounted on the table, so that the dresser could be removed and replaced as needed. Of course, the axis of the dresser spindle must be exactly parallel to the table; otherwise, errors will accumulate between the pick-up or indicating position and the dressing position.

A dial indicator is employed to make the initial setting in dressing the wheel for form-grinding. This operation is illustrated in Fig. 1, where it can be seen that the die section is placed on the chuck and an indicator replaces the diamond in the yoke of the dresser to locate the spindle center relative to a pilot hole in the work. This setting is made in exactly the same manner as on a jig boring machine by rotating the spindle.

The dials and the rough setting scales are set to zero at this point. It will be evident that the initial setting can also be made by using a 2.000-inch square block having a hole exactly in the center, set directly on the face of the chuck against the back stop. By using an indicator in this hole, the work can be measured directly from the chuck.

After the initial setting is made, the dresser head is moved to the first position of the form, using the dimensions laid out by the coordinate method and measuring the distance directly on the dials. The dresser settings for the radius and angles at this section of the form are then made, and all of the stops are set accordingly and locked. The machine table now is moved to bring the diamond point under the center of the grinding wheel, and the table stops set so that this position can be duplicated easily. The wheel is then brought into contact with the diamond and dressing is accomplished.

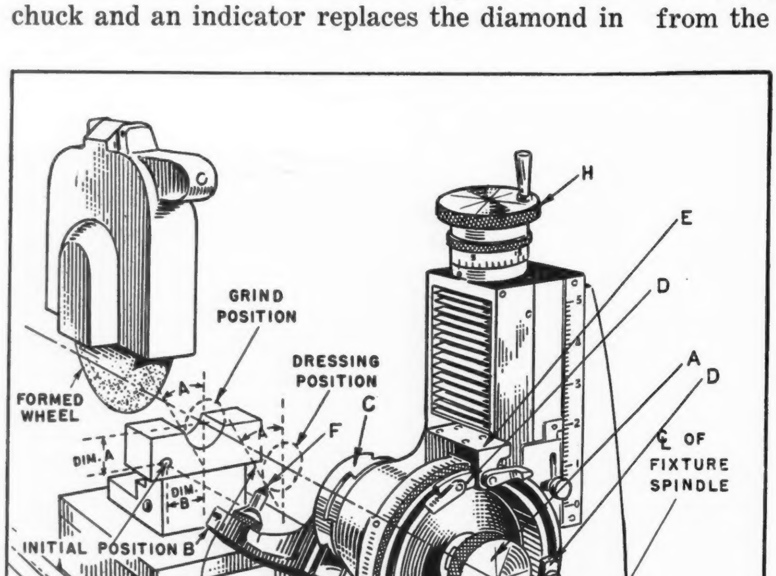
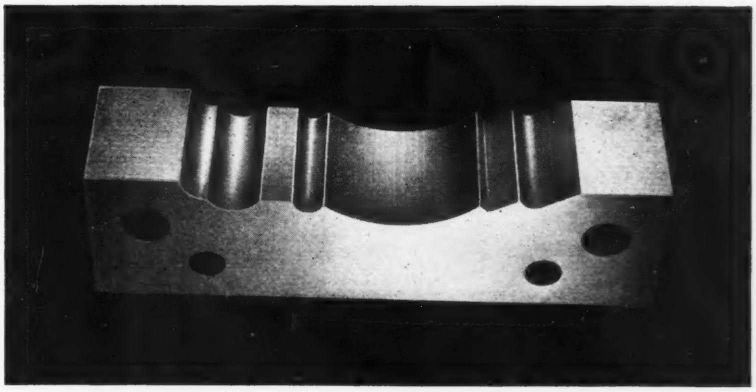


Fig. 6. Diagram of the set-up used with the dresser for form-grinding and wheel-dressing in relation to a pilot hole in the work

Fig. 7. A typical die section form-ground by the method described in this article



If the form segment to be produced is greater than the width of the wheel, several adjacent grinds are made, dressing the wheel for each and using a common dressing position. The 1-inch radius shown in Fig. 5, for example, was ground in three different steps; first the center section was ground, then the wheel was dressed to grind one side of the form, and finally the wheel was turned around for grinding the other side. The entire form was ground from the solid in an oil-hardening tool-steel block 1 1/8 inches thick, having a hardness of 60 to 62 Rockwell C, in two and a half hours. The finish-grinding operation, using the same wheels, took about one hour, with the results illustrated in Fig. 7. By performing the grinding operation step by step across the block and keeping the wheel shape simple, considerable time is saved, especially in redressing wheels.

It should be noted that in order to compensate for variations in the grinding stock, the wheel must be raised from the work so that the proper down feed can be made carefully in order to avoid burning, which would result from removing too much stock in one pass. This is accomplished by setting an auxiliary pointer on the machine vertical feed wheel to the position of the last dressing, and then, after raising the grinding wheel clear of the work, feeding it down again to the previous position.

Among the advantages gained with this device is the fact that the grinding wheel can be dressed, in many instances, by locating from points that cannot be measured from the work; also, the various portions of a complicated contour can be ground without removing the work from the machine for checking.

The same equipment and process can, of course, be employed in form-grinding templates for profiling machines, circular form tools (see Fig. 8) and other tools in which accurate irregular contours are required.

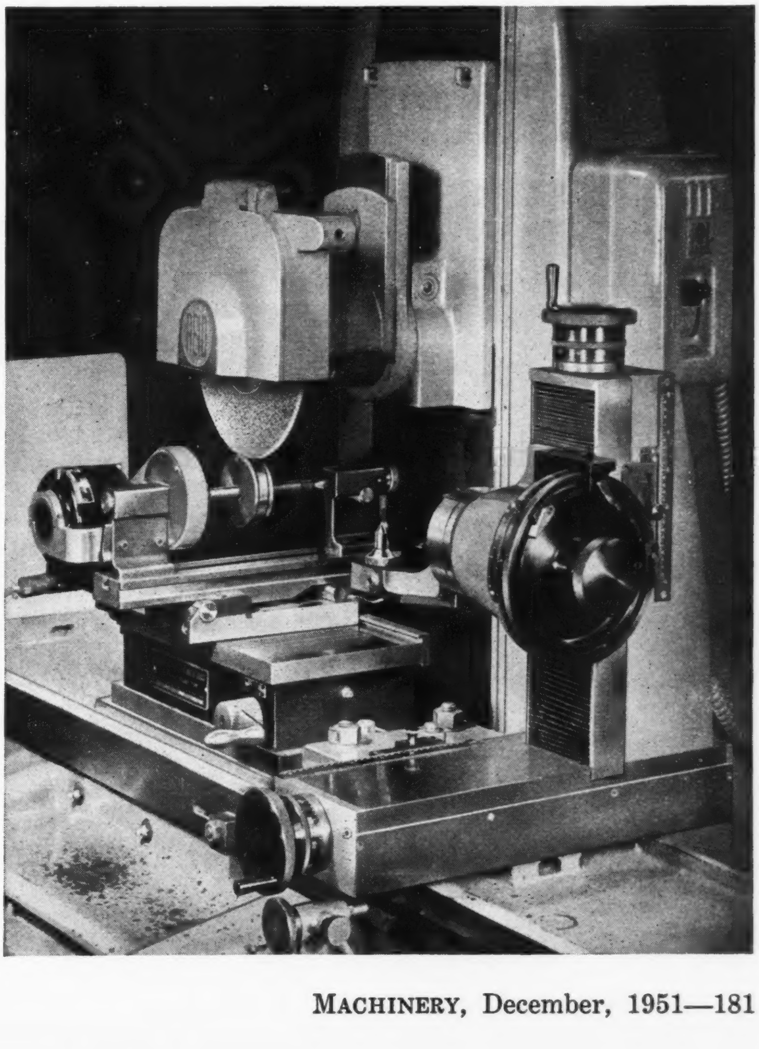
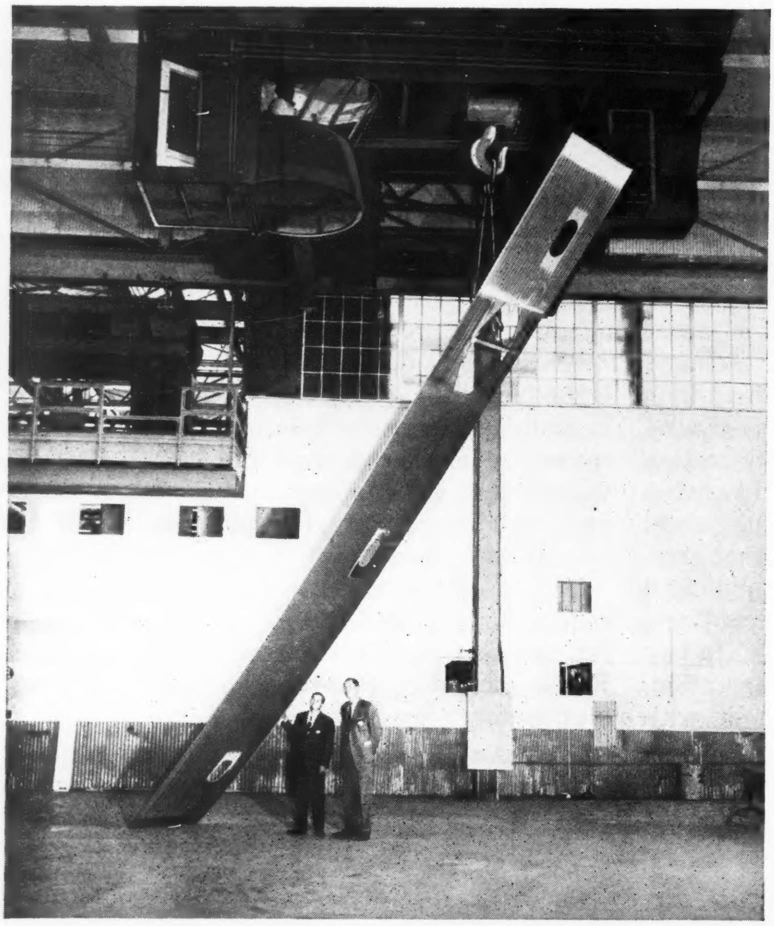


Fig. 8. Circular form tools are among the many irregular-shaped parts that can be form-ground in line with the wheel dresser

In Shops Around the

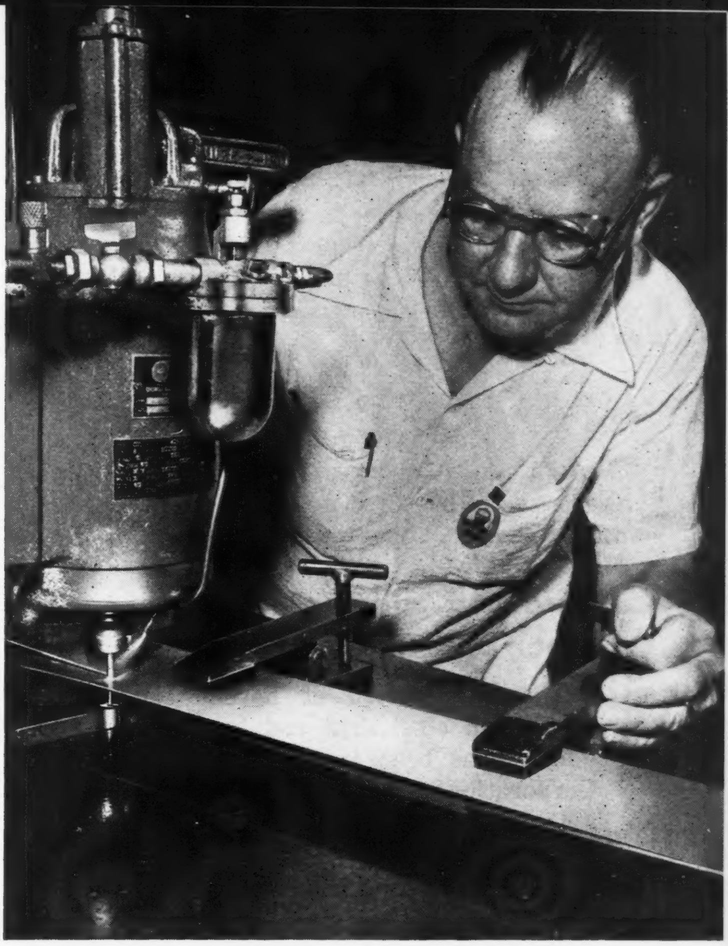


Cut from a solid slab of metal, this one-piece wing section, 32 feet long, for Lockheed Super Constellations will replace some 1500 individual parts and 5000 rivets. It is the largest single-piece wing ever fabricated, and will make the airplanes stronger without adding weight

Trimming the edges of the large dished steel tank head shown below was accomplished with an Oxweld plate-edge preparation unit having three adjustable nozzles on a large stationary boring mill. This tank head is 12 feet in diameter and 3/4 inch thick. The horizontal arm is counterweighted to float back and forth to follow the contour of the work, which is mounted on a turntable. Cutting speed is about 14 inches per minute

Country

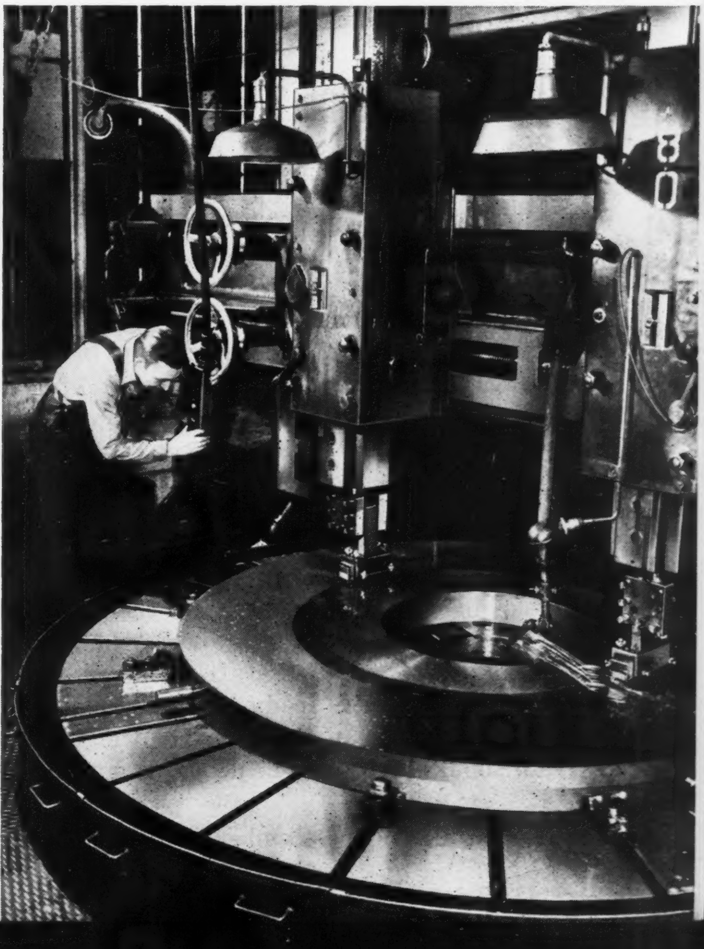
Camera Highlights of Interesting Operations in Some of the Nation's Outstanding Metal-Working Plants



A pressure oiler attachment for tilt table routers, developed by the Texas Engineering & Mfg. Co., Inc., Dallas, Tex., has reduced man-hours by 12 1/2 per cent and added more than 100 per cent to cutter life. A one-quart oil container with an adjustment valve is connected to the router head by a piece of flexible tubing. Pressure is supplied by a compressed-air line

Turbine stages on a shaft 30 feet long are cooled by air and a cascade of water, so that their bores are shrunk tight to the main shaft. This unit, under construction at the General Electric Turbine Divisions, Schenectady, N. Y., is a 60,000-K.W. low-pressure element of a 120,000-K.W. cross-compound turbine

A mirror-smooth finish is produced on the rotating element of an 82,500-KVA hydro-generator thrust bearing in this final grinding operation at General Electric's Large Motor and Generator Department in Schenectady, N. Y. The bearing is required to support a load of approximately 2,000,000 pounds



Materials OF INDUSTRY

The Properties and New Applications of Materials Used in the Mechanical Industries

Hardened and Ground High-Speed Steel Drill Rod

The introduction of hardened and ground high-speed steel drill rod in standard 36-inch lengths has been announced by the Ace Drill Corporation, Adrian, Mich. This drill rod has a toughness equivalent to that of conventional tool steel, and a hardness that is approximately 6 points higher on the Rockwell C scale. It is said to possess uniform toughness, hardness, and strength.

The new drill rod can be obtained as hardened, tempered, and ground blanks ranging from 3/32 to 1 inch in diameter with a tolerance of plus or minus 0.001 inch, or as blanks from 0.118 to 0.515 inch in size, which are hardened and tempered only. It is suitable for punches, knock-out pins, dowel-pins, rollers, plug gages, and tool bits. 1

Stronger Sand Cores Made Possible by Liquid Phenolic Binder

An improved liquid phenolic core-binder resin that facilitates the molding of strong sand cores has been developed by the General Electric Co., Pittsfield, Mass. This resin, designated G-E 12353, has high water dilution and good handling characteristics. Its use is said to result in faster baking cycles, insure less sand "burn in" on the castings, and provide good collapsibility and easy shake-out, which lessens the danger of casting breakage. Low gas formation and high gas permeability enable sounder, smoother castings to be obtained.

The resin is first mixed with water and then mulled thoroughly with sand. After ramming or blowing the treated sand into the core-boxes, the molded core is removed and baked. Following baking at a temperature of about 375 degrees F., the core is ready for the pouring operation. For most applications, the weight of the resin should be 0.5 per cent of the sand weight.

This resin binder can also be used as a spray to increase the hardness of oil- or resin-bonded cores by diluting it with four parts of water. The spray penetrates cores to a depth of about 1/8 inch, and the hard shell that results resists penetration of metal and also protects the cores from breaking. 2

High-Strength, Corrosion-Resistant Plastic Rod

High-strength plastic rod in fractional sizes has been placed on the market by the Dynakon Corporation, Cleveland, Ohio. The new rod is molded of "Dynakon-F," a material of high tensile strength having good electrical and corrosion-resistant properties.

The physical properties include a tensile strength of 100,000 pounds per square inch; a compressive strength of 70,000 pounds per square inch; a flexural strength of 150,000 pounds per square inch; and an impact strength perpendicular to the axis of 70 pound-feet Izod. Its moisture absorption is 0.015 per cent, and its specific gravity 1.9. Electrical properties include an arc resistance of 120 seconds ASTM and a dielectric strength of 280 volts per mil. Its power factor is 2.5.

The rods are resistant to acid and mild alkalies, as well as to salts and most organic solvents. Stand-off insulators, tension rods, chemical equipment supports, and structural members subjected to corrosive atmospheres are among the applications for which these rods are recommended. 3

Emulsion Metal Cleaner for Use in Spray-Washing Machines

A ready-to-use emulsion cleaner known as "Super-Mul" has been announced by the DuBois Co., Cincinnati, Ohio. This is a high-strength, active solvent emulsion cleaner specifically de-

To obtain additional information about materials described here, use Inquiry Card on page 233.

signed for industrial use in spray-washing machines. It rinses freely, resists hard water, and does not sludge out with heavy soil loads.

The new cleaner does not attack metals or painted surfaces. It is free from objectionable odor, is non-toxic, and has a high flash point. Recommended uses include metal cleaning in one-stage washers and cleaning prior to bonderizing, during processing, and before painting. When used in low concentrations in the rinse, it provides interim rust inhibition. It is also useful for precleaning prior to alkaline cleaning and for wipe-down cleaning of equipment and machinery. 4

Diamond Abrasive for Carbide Drawing and Heading Dies

A diamond abrasive prepared especially for lapping and polishing carbide drawing and heading dies has been placed on the market by the Elgin National Watch Co., Elgin, Ill. "Dymo-C," as the new product is called, is said to cut 20 per cent faster than abrasives formerly used for wire-drawing and cold-heading finishing dies. It is available in the following National Bureau of Standards grades: 1, 3, 6, 8, 14, 30, 45, 230 mesh, 170 mesh, and 100 mesh. 5

Volatile Inhibitor Protects Metal Surfaces from Corrosion

Metal parts exposed to air and moisture can be protected from corrosion by the use of VPI crystals, a slightly volatile amine nitrite which has been made available to industry by the Shell Oil Co., New York City. This corrosion inhibitor will be found useful in protecting metal parts, assemblies, instruments, and finished products during shipment, storage, and processing.

Being slightly volatile at atmospheric temperatures, it gives off vapors that protect all surfaces of the metal. It is a powder-like substance which can be applied by placing it in a package enclosing the parts to be protected; by blowing it into the area to be protected; and by putting it into a water or alcohol solution for protecting metal parts between steps of such operations as grinding. An unusual characteristic of this inhibiting agent is that it will arrest corrosion at advanced stages.

It is claimed that one gram of this substance will protect a cubic foot of metal parts or surface for periods up to a year. Solutions of from 2 to 4 per cent are effective in protecting processed metal parts. Two types of the corrosion inhibitor are available—VPI 260 and VPI 220, which has greater vapor pressure but less stability at higher temperatures.

Both types have proved effective in preventing corrosion in aircraft engines, precision instruments, tools and dies, Diesel engines and parts, sand-blasted parts, continuous steel strip, steel rods, steel forgings, ball and roller bearings, water pumps, large fabricated sheet-metal components, stamped parts which are to be plated, and tank trailers. Crystals of this substance have also been used as inhibitors in hydraulic fluids and in water soluble paints for general-purpose industrial coatings that are required to be corrosion-resistant. 6

Nickel-Steel Electrodes for Welding Armor Plate

Two new grades of ferritic welding electrodes for use with high-strength steels and armor plate have been brought out by the Arcos Corporation, Philadelphia, Pa. These electrodes, designated Tensilend 100 (Grade 230) and Tensilend 120 (Grade 260) are composed of standard welding quality mild steel cores covered with an electrode coating containing powdered nickel, ferro-molybdenum, and ferro-vanadium. Since these electrodes may be used to replace electrodes containing 25 per cent chromium and 20 per cent nickel, a saving of these critical metals can be effected.

Physical properties of these weld metals include tensile strengths of over 100,000 pounds per square inch and elongations of 19 to 22 per cent in 2 inches. The composition of the two grades is as follows:

	Tensilend 100	Tensilend 120
Carbon, Per Cent	0.06	0.06
Manganese, Per Cent	0.55	0.90
Silicon, Per Cent	0.40	0.40
Nickel, Per Cent	1.80	1.80
Molybdenum, Per Cent	0.60	0.80
Vanadium, Per Cent	0.10	0.25

. . . . 7

Accelerator for Casting Resin Speeds Up Hardening

Casting resin can be hardened quickly without heat by the addition of a liquid accelerator known as "Quick-Set." This product has been introduced by Rezolin, Inc., Los Angeles, Calif. It eliminates the use of ovens and over-night hardening, thereby resulting in faster production of master models, duplicating and foundry patterns, and jigs and fixtures. Control of hardening time is made possible by increasing or decreasing the amount of accelerator used. 8

To obtain additional information about materials described here, use Inquiry Card on page 233.

Machine Tool Builders Hold

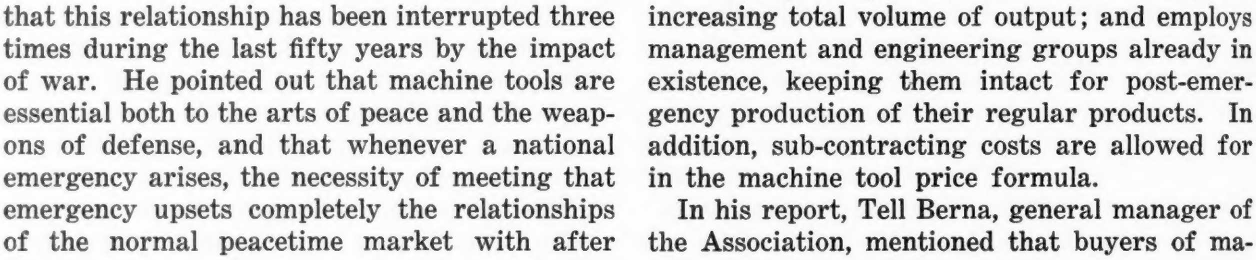
DEFENSE problems come first with the members of the National Machine Tool Builders' Association in the present emergency, and that was the subject of Richard E. LeBlond, president of the Association and president of the R. K. LeBlond Machine Tool Co., in his opening address before the fiftieth annual meeting held at the Homestead, Hot Springs, Va., on November 7 to 9, inclusive. Mr. LeBlond pointed out, in his talk, that the Association was started in the spring of 1902, when seventeen lathe builders met in New York City at the invitation of William Lodge, then president of the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio. The total output of the machine tool industry in that year had a value of only about $23,000,000.

Mr. LeBlond noted that the industry has been definitely related to the invention and development of devices designed to add to the convenience and the comfort of modern civilization, but that this relationship has been interrupted three times during the last fifty years by the impact of war. He pointed out that machine tools are essential both to the arts of peace and the weapons of defense, and that whenever a national emergency arises, the necessity of meeting that emergency upsets completely the relationships of the normal peacetime market with after effects that require years for their solution. When such an emergency occurs, it is necessary to deal with people who do not understand the nature and functions of machine tools.

The first phase of the defense cycle is inevitably one of difficulty in obtaining priorities, confusion as to requirements, and delays. A whole year was spent after the fighting broke out in Korea in completing that cycle. Today the Government is fully aware of the part that machine tool builders play in the emergency and has promised wholehearted cooperation.

Mr. LeBlond cited three ways of expanding machine tool output to meet production schedules: First, by hiring more people and using multiple shifts, in order to utilize to the fullest extent the present facilities; second, by plant expansion; and third, by sub-contracting. He thought the latter to be the most practical method of obtaining results in the shortest period of time, because sub-contracting utilizes manpower where it is now employed; eliminates the need for building new plants; is the fastest method of increasing total volume of output; and employs management and engineering groups already in existence, keeping them intact for post-emergency production of their regular products. In addition, sub-contracting costs are allowed for in the machine tool price formula.

In his report, Tell Berna, general manager of the Association, mentioned that buyers of machine tools for the defense program are making a practice of inserting clauses in their orders



The newly elected officers of the National Machine Tool Builders' Association are (left to right) president, Frederick S. Blackall, Jr.; first vice-president, Swan E. Bergstrom; and second vice-president, Herbert L. Tigges

Fiftieth Annual Meeting

that are placed in the prime contract by the Government Contracting Officer. He reminded the machine tool builders that they are completely at liberty to accept or refuse any contract terms as they please. He then discussed stipulations which are required by law or originating from the procurement policies adopted by the Department of Defense.

Mr. Berna also commented on the fact that in normal times 25 per cent of the output of the machine tool industry goes overseas, but that in 1950 this percentage began to fall off and it now stands at about 10 per cent. The importance of the foreign market is not for the immediate present, but for the future, because there have been many years when orders from overseas customers enabled machine tool builders to stay in business. If the machine tool builders had not worked hard to develop highly skilled sales representatives overseas, they could not have shipped thousands of machine tools to Europe for the mutual defense assistance program with the assurance that the machines could be promptly put into operation and properly serviced. Mr. Berna then read a letter from five French distributors of machine tools, in which they cited difficulties they are experiencing as a result of the unavailability of American machine tools at the present time and the increased competition from European manufacturers.

In his paper "Cooperation with Government," M. A. Hollengreen, chairman of the Government Relations Committee and president of the Landis Tool Co., emphasized the fact that increased government control of the American economy makes it imperative that the machine tool industry have the cooperation of the Government if the industry is to do its proper job in the defense program. The widespread reluctance of outstanding government authorities at the time of the outbreak of war in Korea to recognize the basic importance of an increased production of machine tools has gradually vanished. There is now a frank recognition on the part of practically everyone in Washington that steps must be taken to substantially increase machine tool output if the defense program is to be completed within a reasonable period of time.

Mr. Hollengreen mentioned that, in the field of finance, a great deal has been accomplished during the last few weeks to assist the machine tool builder. The industry, having experienced a declining market from 1942 until the end of 1949, was not in a position to finance a drastic increase in production. Nevertheless, the industry did double its output from June, 1950, to June, 1951.

The General Services Administration has arranged to lease machine tools needed by machine tool builders or their sub-contractors to increase production. The same Administration also offers its cooperation, along with the Metal-Working Division, in arranging for the guarantee of a loan which a machine tool builder may desire to make from his own bank, and has arranged with the Federal Reserve Bank for this guarantee to be made under the sponsorship of the General Services Administration. Mr. Hollengreen also discussed control of materials and manpower problems in machine tool plants.

Kermit T. Kuck, vice-president of engineering, Monarch Machine Tool Co., described the first European Machine Tool Show, which was held in Paris during the first ten days of September under the sponsorship of the European Committee of Cooperation of Machine Tool Industries. More than 800 exhibitors participated, over 280,000 square feet of floor space being used for displaying approximately 2000 machine tools. The three principal countries exhibiting were France, with 459 manufacturers; Germany, with 173 manufacturers; and Switzerland, with 71 exhibitors. There were 18 exhibitors from the United States.

Mr. Kuck observed that the French manufacturers had developed many new ideas for general-purpose tools and that Italy's machine tool builders had also made remarkable progress. He was particularly impressed, however, with the tremendous recovery made by the German machine tool industry despite the fact that after the war many of the prominent machine tool factories in that country had been stripped of their production facilities. Prior to the war, there were approximately 200 firms in Germany building machine tools; at present, in the Western Zone alone, there are about 450 concerns.

Among the various machines mentioned by Mr. Kuck was a turret lathe, of which the main feature is an automatic control mechanism that utilizes a punched card, similar in principle to those used on office machines, for quickly setting speeds and feeds. The card carries the sequence of operations to be performed by the machine, and is placed over an electrical panel recessed in the front of the headstock. It serves as a template for inserting plugs in the panel at the proper places to produce the desired speed and

feed. The card can be easily removed and placed in a file, where it is readily available when the same job is next run on the machine.

On a gear-hobbing machine, equipped for automatic "jump" hobbing to cut a number of sets of teeth at various positions along the work-piece, a similar pre-punched card is placed over a selector plate to indicate the positions for plugs to trip the cycle switches.

Planers arranged to cut in both directions of table travel at variable speeds up to 330 feet per minute are equipped with controls whereby the table is rapidly accelerated and decelerated so that a minimum amount of table travel is required for reversing.

Nearly every lathe of any prominence was equipped with some form of tracer control. Duplicating equipment was also to be found to a lesser degree on milling machines, boring machines, and planers.

Alexander H. d'Arcambal, chairman of the Committee on Metallurgical Problems and vice-president and general manager of Pratt & Whitney, delivered a paper entitled "Alternate Steels to Conserve Critical Alloying Elements"; and Swan E. Bergstrom, vice-president of the Cincinnati Milling Machine Co. and director of the Metal-Working Machinery Division of the National Production Authority, discussed the subject of "Expanding Machine Tool Production." Joel Barlow, of Covington & Burling, spoke on the new renegotiation procedure. The speaker at the annual dinner was Colonel Willard Chevalier, executive vice-president of the McGraw-Hill Publishing Co., who gave an address entitled "Industry in an Arsenal Economy."

Frederick S. Blackall, Jr., president of the Taft-Peirce Mfg. Co., Woonsocket, R. I., was elected president of the National Machine Tool Builders' Association; Swan E. Bergstrom was elected first vice-president, but was given a leave of absence while he serves as director of the Metal-Working Equipment Division of NPA; Herbert L. Tigges, executive vice-president of Baker Brothers, Inc., Toledo, Ohio, was elected second vice-president and a director; and Jerome A. Raterman, president of the Monarch Machine Tool Co., Sidney, Ohio, was re-elected treasurer. New directors elected, in addition to Mr. Tigges, were as follows: Ralph S. Howe, executive vice-president, New Britain Machine Co., New Britain, Conn.; and William A. Dermody, president and general manager, Carlton Machine Tool Co., Cincinnati, Ohio.

American Welding Society Awards

Winners of the 1951 Resistance Welder Manufacturers Association contest were awarded prizes totaling $2250 at the annual meeting of the American Welding Society, held at Detroit in October. The best paper from an industrial source was submitted by W. L. Roberts, research engineer, Westinghouse Electric Corporation, who received the first prize of $750; second and third awards were made to D. H. Fleig, American Electric Fusion Corporation, and C. S. Seltzer, of Detroit, who received $500 and $250, respectively.

The best papers from a university source were submitted by Rensselaer Polytechnic Institute engineers—Dr. Ernest F. Nippes and John N. Ramsey, who received first prize of $300 for a paper jointly prepared. Dr. Nippes also shared in the $200 second prize together with co-authors J. M. Gerken and J. G. Maciora. William H. Colbert, a student at the University of Cincinnati, won the $250 undergraduate award.

* * *

An all-time record of 6,665,863 passenger cars having a wholesale value of $8,633,272,000 were produced in the United States during 1950.

Shrink Table Book

Decimal equivalents for all dimensions from 1/64 inch to 12 inches with compensation for material shrinkages from 1/32 inch per foot to 1/2 inch per foot are included in a book of "Shrink Table Sheets" recently published. With each equivalent corrected to four decimal places, these sheets provide the engineer, diemaker, patternmaker, and toolmaker with a precision method of checking or establishing measurements that involve known shrinkage in ferrous and non-ferrous metals or plastic materials. By their use, the need for an extensive assortment of shrink-rules is eliminated.

The data applies to patterns and dies for making castings by sand, permanent-mold, die-casting, and "C" processes. The tables cover 768 readings. Copies of the book are available from the Arrow Pattern & Engineering Co., Box 823, Erie, Pa., at $1 each.

* * *

Steel furnaces in the United States poured an average of more than eight million tons each month in 1950. Every month their output exceeded a full year's production in all but four foreign countries.

TOOL ENGINEERING *Ideas*

Tools and Fixtures of Unusual Design and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Gages for Checking Depth of Keyways

By M. MORAN, Newark, N. J.

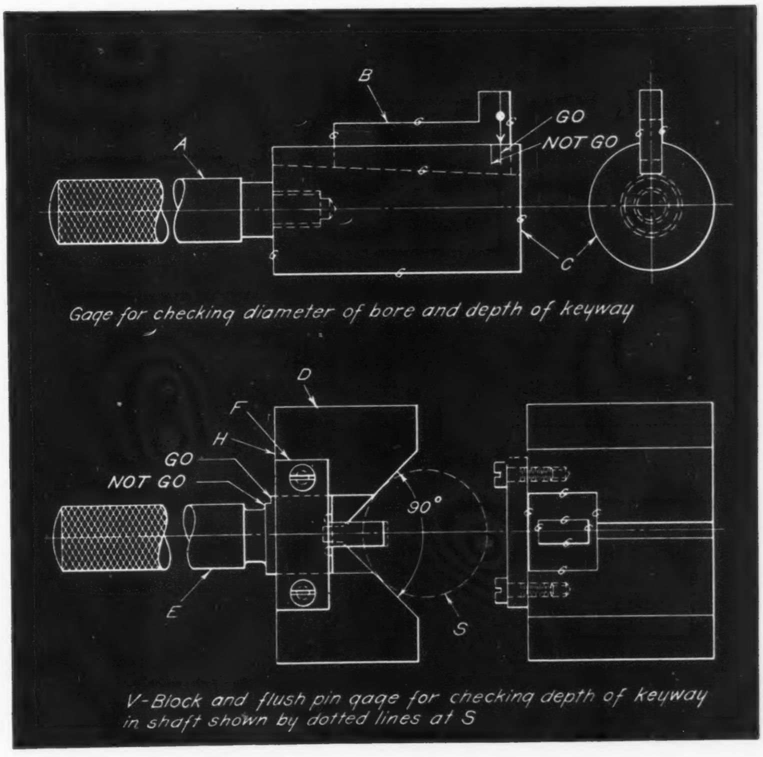
Two easily made gages, one for checking the bore and keyway in a part and another for checking the depth of keyway in a shaft, are shown in the accompanying illustration. These gages provide a simple means of checking the parts to assure cutting the keyways to the correct depth and finishing the bore to fit a shaft without looseness when the parts are assembled.

The gage for checking the diameter of bore and depth of keyway consists of three parts—the tool-steel plug *C*, a knurled handle *A*, and the keyway depth gage *B*. Plug *C* is drilled and tapped to receive handle *A*, and has a slot machined in it at an angle of about 3 degrees with its axis. This slot is finished to a nice sliding fit for keyway depth gage *B*.

Plug *C* is hardened and ground on the surfaces indicated. The cylindrical portion is ground to a close sliding fit for a bore of the correct diameter to give the desired fit when assembled on a shaft of specified size. The keyway gage is also made of tool steel, and is hardened and ground on the surfaces indicated.

In using this tool, the plug *C* is first inserted in the bore to be gaged. To pass inspection, the bore must be just large enough to admit the plug with a close gaging fit. Assuming that the bore passes inspection, the depth of the keyway in the bore can next be checked by sliding gage *B* into place until it is a close wedge fit between the bottom of the slot in plug *C* and the bottom of the keyway in the bore. If the arrow point scribed on the side of gage *B* coincides with either the "Go" or "Not Go" line scribed on the cylindrical surface of plug *C* or is located between these lines, the depth of the keyway is within the required tolerance, and the part is passed as satisfactory.

The gage shown in the lower view of the illus-



Gages designed to facilitate machining bores and keyways to insure close fits when keys are fitted in shafts assembled in bores

tration consists of a V-block *D*, a flush pin type keyway depth gage *E*, and a plate *F* secured to the V-block by cap-screws. The V-block *D* serves to locate the gage in the correct position on the shaft for gaging the depth of the keyway. Flush pin *E* has a knurled handle, and is hardened and ground. It has a rectangular section with "Go" and "Not Go" steps and a tongue at the end which is accurately ground to a sliding fit for the keyway to be gaged.

The rectangular section of the flush pin is ground on all four sides to a close sliding fit in a slot in the end of the V-block. The gaging tongue and rectangular section of the flush-pin are accurately centered, so that the gaging tongue will slide into an accurately machined keyway in the shaft when the V-block is in place on the shaft. Plate *F* serves to hold the flush pin in the slot in the V-block.

In use, the gage is placed on the shaft indicated by dotted lines at *S*. The flush pin *E* is then pushed in until the end of the gaging tongue is in contact with the bottom of the keyway in the shaft. In order to pass inspection, either the "Go" or the "Not Go" step on the flush pin must be flush with surface *H* of the V-block, or surface *H* must be located between the "Go" and "Not Go" steps.

Spring Chuck and Fixture for Grinding a Molded Plastic Bushing

By ROBERT W. NEWTON, Poughkeepsie, N. Y.

Grinding was found to be the best method of machining the outside diameter and the inside slot in the molded plastic bushing illustrated in Fig. 1. The slot on the outside was produced in the molding operation.

The spring chuck shown in Fig. 2 is a fast and

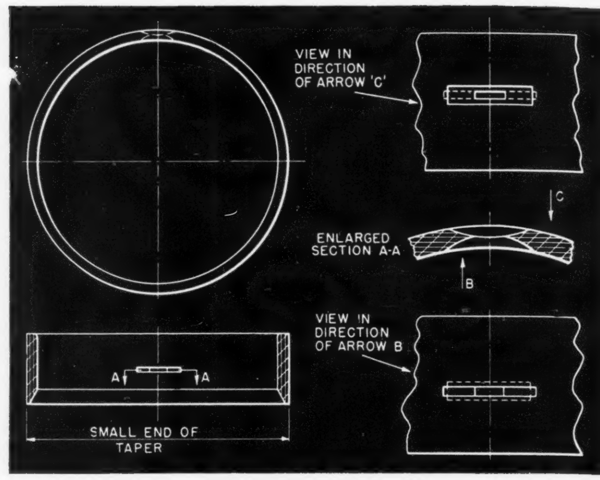


Fig. 1. Molded plastic bushing in which a slot is ground on the inside periphery and the tapered outside diameter is ground with the tools illustrated in Figs. 2 and 3

accurate tool for holding the work-piece while grinding the tapered outside diameter. The fixture illustrated in Fig. 3 was designed to grind the slot in the inside periphery of the piece so that the minimum width opening would be free from burrs. As production requirements for this bushing are high, both of the tools had to be designed for quick loading and fast operation.

The spring chuck is counterbored and threaded to fit the end of the headstock of a Norton cylindrical grinder. The end of the chuck is ground to provide a slip fit for a hole in a spring collet. This centers the collet on the machine. The collet is slotted and spring-tempered. An expansion of about 0.030 inch is obtained by means of a tapered hole in the end of the collet that fits a tapered portion on the chuck. The outside diameter of the collet is ground to fit the work-piece when the collet is expanded. A draw-bar, which is inserted through the grinder headstock and the chuck, expands and releases the collet by moving it up and down on the tapered portion

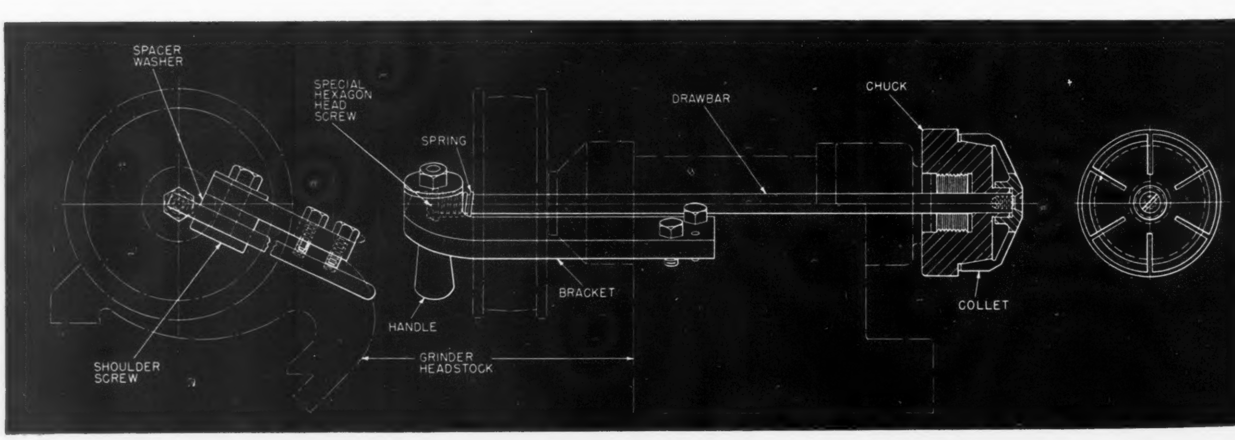


Fig. 2. Special spring chuck employed in a cylindrical grinder for grinding the tapered outside diameter of the molded plastic bushing shown in Fig. 1

of the chuck. The draw-bar is fastened to the collet with a flat-head cap-screw.

For operating the draw-bar, a bracket is screwed and doweled to the side of the grinder headstock. Through the end of the bracket a hole is reamed to provide a slip fit for a special shoulder screw with a large-diameter head. In order to have a means of tightening and loosening this screw, a screwdriver slot is machined in the head end of it. A handle, the end of which extends over the draw-bar, is assembled between the head of the screw and a thick washer.

The handle is held loosely in place with a standard washer and a hexagon nut. A special hexagon-head screw is fastened into the end of the draw-bar. Assembled between the head of this screw and the end of the grinder headstock is a compression spring, which holds the collet in the expanded position. When the handle is moved, the spring is compressed, and the collet is thereby released.

The grinding fixture shown in Fig. 3 has a cast-iron body to which is fastened a high-speed portable electric grinder, a sliding locator, and an adjustable stop. A bracket for holding the grinder fits in a slot on the inside of the vertical portion of the body. A cap is screwed and doweled to the end of this bracket. The bracket and cap are bored to fit the grinder in assembly and a clearance hole for the grinder is provided in the top part of the body.

Adjustment of the height of the grinding wheel from the top surface of the body is provided by means of a knurled-head screw operating against the bottom of the bracket. A piece of drill rod can be inserted in any one of four holes drilled in the knurled head of the screw for turning it.

Two guide strips are fastened to the top of the fixture body. The distance between these strips is about 1/16 inch greater than the large end of the tapered outside diameter of the work-piece.

The end of the sliding locator is arc-shaped, and is machined to fit the tapered outside diameter of the work-piece. A sliding block is fastened to the arc-shaped end of the locator and is a slip fit in a slot in the top surface of the body. A socket-head cap-screw, fastened to the body through a slot in the sliding locator, holds the locator in place.

After being adjusted to provide a slip fit between the work and the locator, the cap-screw is locked in position with a hexagon check-nut. A piece welded to the locator fits the slot molded

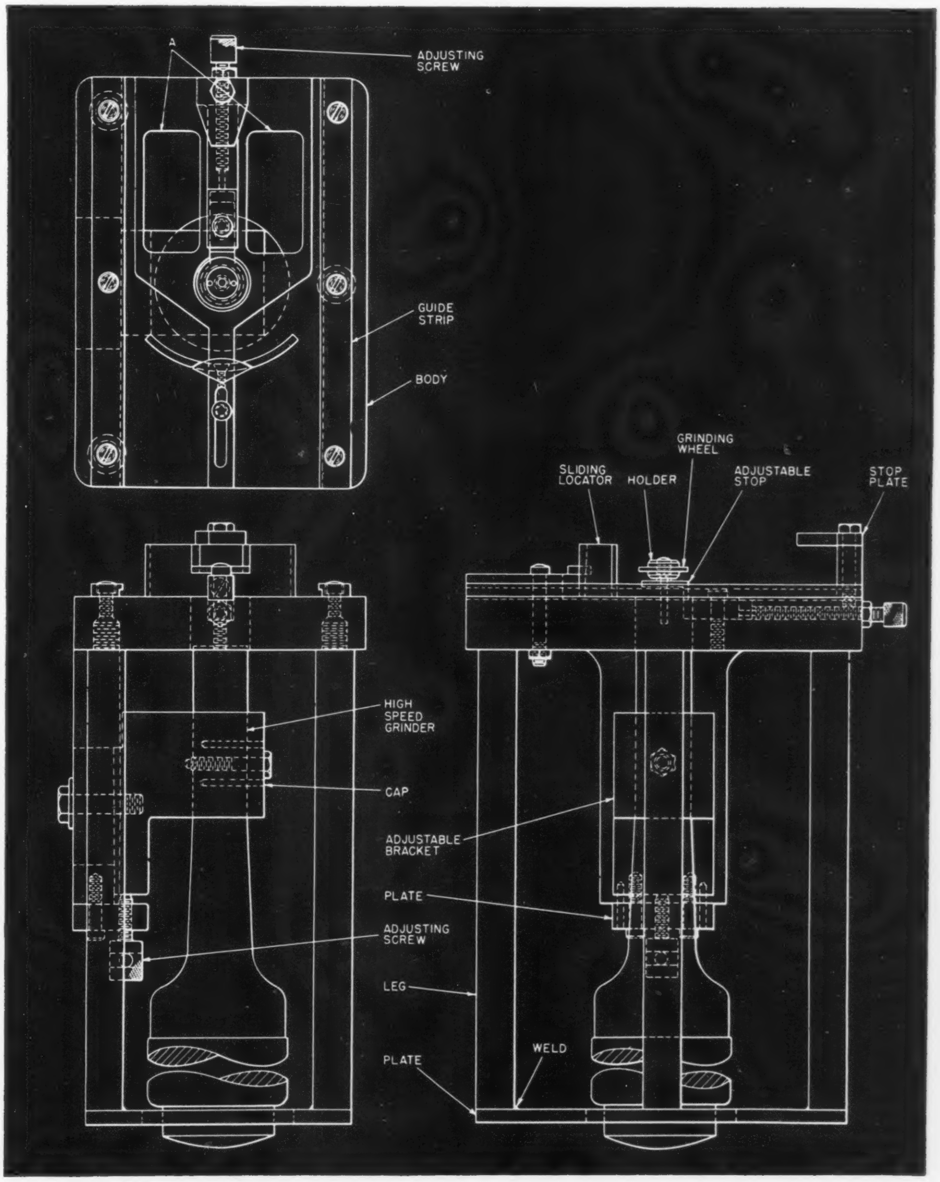


Fig. 3. Fixture used with a high-speed electric or air grinder for producing the slot on the inside periphery of the molded plastic part shown in Fig. 1

in the outside of the work-piece, and has the same radius as the slot. This locates the work-piece radially for the grinding of the inside slot.

A work-piece is loaded on the fixture by slipping it under a plate at the end of the body. This plate holds the work-piece down while it is being ground. The adjustable stop slides in a deep slot in the body, and its end is cut away to clear the grinder spindle. A large hole through the portion that is left provides ample clearance around the shank of the grinding wheel holder for the movement of the stop necessary to adjust it for wheel wear. The stop is set in the correct position by a knurled-head screw, which can be locked in position after the proper setting has been made.

A holder for the grinding wheel is fitted to the spindle of the portable grinder. The top of the holder screws onto a threaded portion of the spindle, so that it can be adjusted for grinding wheels of different thicknesses. Two small pins that serve as drivers are driven into the top plate and fit holes in the grinding wheel.

Two slots *A* machined through the top portion of the body aid in the removal of chips. Three legs, to the bottom of which a plate is welded, are screwed into the under side of the top portion of the body to complete the framework of the fixture. A clearance hole for the grinder is machined in the bottom plate.

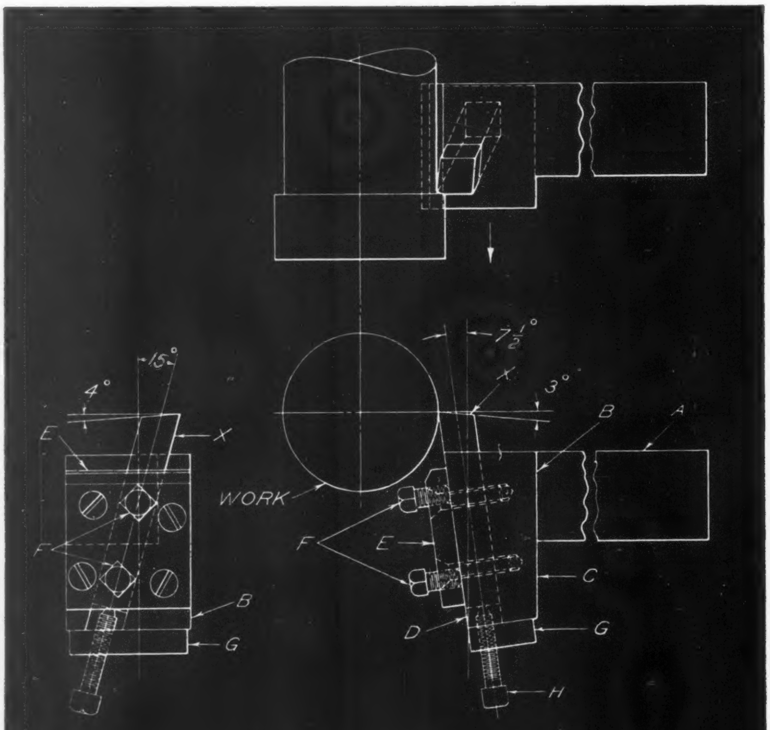
This fixture can be set up in any suitable place and connected to an air line or electrical outlet, depending on the type of grinder to be used.

Lathe Tool Bits Held Vertically in a Modified Holder

By W. M. HALLIDAY, Birkdale, Southport, England

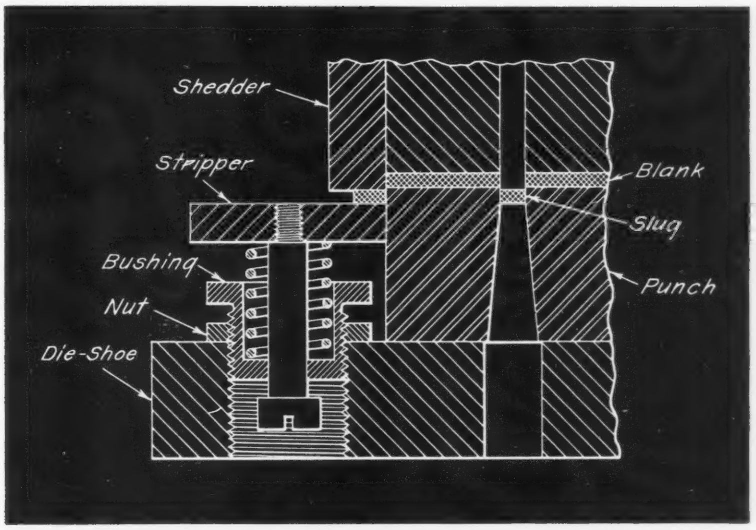
A modified form of lathe tool-holder in which standard square or rectangular tool bits are held in practically a vertical plane is illustrated below. Cutting is done by the upper end face of the bit, which is ground to provide the desired rake angles and round nose. With this design, the main cutting loads will be directed substantially along the full length of the bit, thus insuring a high degree of stiffness and resistance to deflection. Such a holder permits heavy stock removal, high rates of feed, and a good surface finish, with minimum tool breakage and long tool life between sharpenings.

Shank *A*, which is an integral part of tool-holder *B*, is machined to fit the toolpost of a lathe. A shoulder *C*, between the body and the shank of the holder, can be set to bear against the front of the toolpost body. The angular slot *D*, machined in the face of the holder, provides a sliding fit for the tool bit *X*. The compound angle of the slot (see upper view) provides the required end clearance (7 1/2 degrees) and side relief (15 degrees) for the tool bit, and it is only necessary to grind the back-rake angle (3 degrees) and side-rake angle (4 degrees) on the top face of the bit. These angles or the angular disposition of the slot can be varied to suit the material being cut and other conditions.



Lathe tool-holder in which tool bit (X) is held in practically a vertical plane. With this arrangement, heavy stock removal is possible at high rates of feed

Arrangement for adjusting height of stripper after regrinding blanking punch. The threaded bushing is screwed into the die-shoe a distance equal to the amount the punch is shortened. Thus the space for the coil springs is not reduced, as the holding screws are not shortened



The tool bit is confined within the slot by plate *E*, which is secured to the front face of the holder by four screws and held in the desired position by two clamping screws *F* that bear directly on the bit. Permanently secured to the bottom of the holder by screws or by welding is a stop-plate *G*. Threaded through this plate and bearing on the bottom face of the tool bit is a long set-screw *H*, which is used to adjust the height of the bit in the holder. When the bit becomes short, it can be raised in the holder by inserting back-up blanks between the bit and the set-screw.

Stripper Spring Adjustment for Compound Dies

By FEDERICO STRASSER, Santiago, Chile

When a stationary punch incorporating a piercing die serves as the blanking punch member of a compound die, the resharpening of the punch necessitates readjustment of the height of the corresponding movable stripper. This adjustment must be carefully made in order to maintain the original surface relationships among the various members of the die.

If the adjustment is effected by shortening the holding screws, as is usually the case, the space allowed for the helical springs that back up the stripper will eventually become too small to permit the springs to operate properly. Actually, helical springs should not be compressed more than one-quarter to one-third of their free length. The repeated shortening of the holding screws is also troublesome.

To overcome these difficulties, the arrangement here illustrated was developed. This permits easy, quick regulation of the stripper height with micrometer sensitivity, and maintains a space of constant height for the helical springs. A threaded bushing fits into a tapped hole in the die-shoe, and is clamped in position after setting by means of a lock-nut. The bushing fills the double purpose of housing the coil spring and limiting the upward travel of the holding screw.

Each time the punch is sharpened, the bushing is screwed into the die-shoe, a distance equivalent to the amount the punch is shortened by the regrinding operation. Thus the holding screw is not shortened, the space for the coil springs is not altered, and the original height relationship between stripper and punch is maintained.

* * *

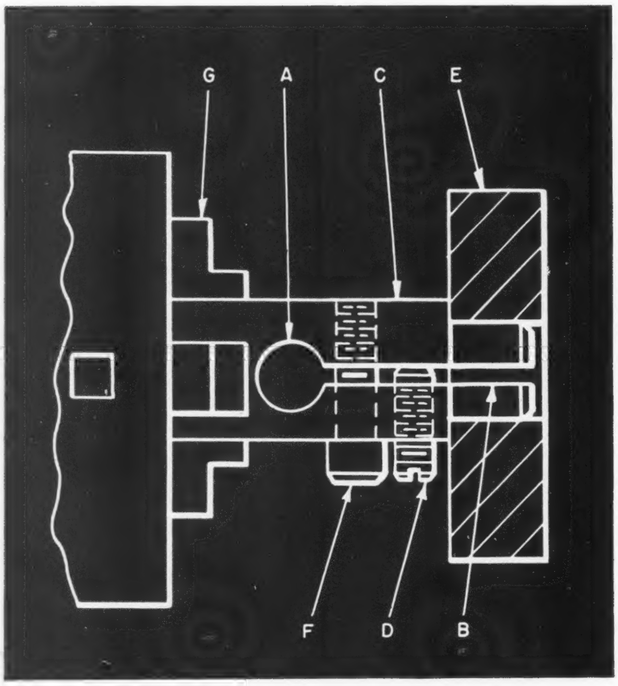
Motion Picture on the Production of Steel Castings

A 16-millimeter full-color motion picture covering many phases of modern steel foundry operations and techniques for the production of carbon steel, special alloy, and stainless steel castings has just been completed by the Lebanon Steel Foundry, Lebanon, Pa. This film, entitled "Steel with a Thousand Qualities," runs thirty-seven minutes. It is available to industrial and manufacturing groups, engineering societies, and educational institutions upon request to Modern Talking Picture Service, Inc., 45 Rockefeller Plaza, New York 20, N. Y.

* * *

A new engineering laboratory, constructed at a cost of $275,000, was recently dedicated at Princeton University. Two-thirds of the space —approximately 100 square feet—is to be used as an instruction machine shop and a maintenance machine shop.

Ideas for Shop and Drafting-Room



Simple expansion arbor for performing second-operation work in a lathe. By tightening screw (D), the slotted end of bar (C) is expanded in the bore of work-piece (E)

Expansion Arbor for Second-Operation Lathe Work

By JAMES J. BAULE, Brooklyn, N. Y.

A simple but effective method of holding parts in a lathe for second-operation work is shown in the illustration above. This expansion arbor is especially applicable when considerable quantities of small or medium size work-pieces must be turned, chamfered, beveled, formed, or faced.

To make the arbor, a hole *A* of suitable diameter is drilled through the round cold-rolled steel bar *C*, and a slot *B* is milled or sawed in the end of the bar to obtain a slight spring effect. Screw *D* passes half way through the bar and contacts one side of the slot as shown. When this screw is tightened, the arbor is expanded, sufficient pressure being exerted on the bore of the work-piece *E* to prevent horizontal movement and yet permit rotation. Screw *F* can be tightened to draw the split parts of the bar together if they over-expand during use.

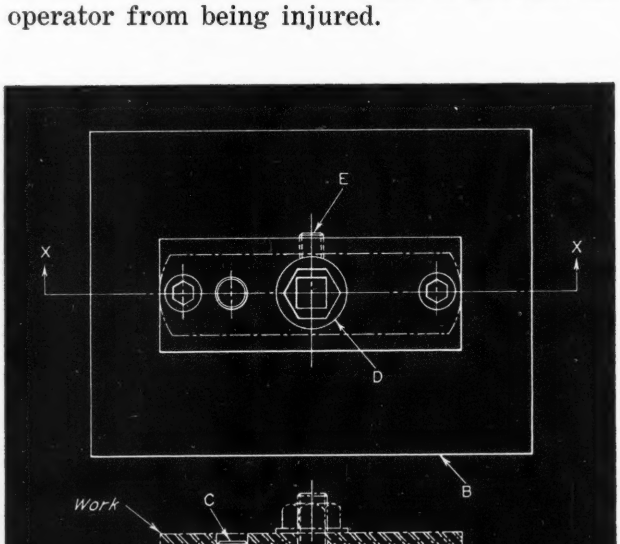
The expansion arbor is secured in a three- or four-jaw chuck *G* or in a collet on the lathe spindle, and its slotted end is turned to the proper diameter and length to suit the work. This reduced section of the bar should be shorter than the length of the bore in the work to permit chamfering the bore. Since the work-piece always rests against the shoulder on the arbor, a positive stop can be employed on the lathe, or the carriage can be locked, when a series of operations is to be repeated on a lot of parts.

Simple Fixture for Assembling Hexagon Nuts in a Lift Arm

By IRVING MANSFIELD

The accompanying illustration shows an easily built inexpensive fixture for assembling hexagon nuts in a power lift arm. A casehardened steel block *A* is screwed to base *B*, and a standard dowel *C* is pressed into block *A*. Dowel *C* enters a previously punched hole in the work to keep it from turning. A hole is bored in the center of block *A* to receive a standard type hexagon socket *D*, which is held in place by set-screw *E*.

In use, the hexagon-head screw is dropped head first into socket *D*. The work is then placed on top of block *A*, and a nut and washer are assembled on the screw by using a power air wrench. The fixture should be securely clamped to the assembly bench, in order to prevent the operator from being injured.



Fixture for quickly assembling nuts and screws to a power lift arm

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Non-Delivery of Letter Cancelling a Sales Contract

C. F. G.—What is the law on sales contracts cancelled by the seller in a letter that the purchaser testifies he has not received? We have a case where we cancelled a sales contract by letter and the purchaser states he did not receive the letter and wants us to pay him damages.

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

The Federal postal laws state that when the writer of a letter on which the postage is prepaid writes or prints his name and address on the outside of the letter, and such letter remains uncalled for at the post office to which it is addressed, the postmaster shall return the letter to the writer without additional charge for postage. If the writer has written or printed on the envelope the date the undelivered letter shall be returned to him, the postmaster must return it to the writer according to these instructions. On the other hand, if the writer fails to specify when the undelivered letter shall be returned to him, the postmaster may use his own judgment on what date he shall return the letter.

If the addressee denies that he received the letter and the writer testifies that it was not returned to him, the law presumes that the addressee received it, provided the writer proves that he addressed the envelope properly, placed the required postage on the envelope, and deposited it in a Post Office or government mail box.

For example, in Adams vs. Plaza Theatre [43 S. E. (2d) 47], the controversy involved a contract which stated that unless written notice of an intention to terminate the contract is given by one Adams, the contract would renew itself. The crucial point in the case was whether one Robert received the letter. If he did, then the contract was void. If he did not receive it, Robert was entitled to a renewal of the contract.

The lower court decided that Robert had not received the letter, and therefore that the contract was automatically renewed. However, the higher court reversed the verdict, saying that the law presumes that the addressee of a properly posted and addressed letter received it.

Effect of Alloying Elements on Properties of Steel

L. M. G.—In selecting a steel for a specific purpose, it is important to know what effect different alloying elements have on the characteristics of the steel. Can you give us a general idea of the effects of the various elements?

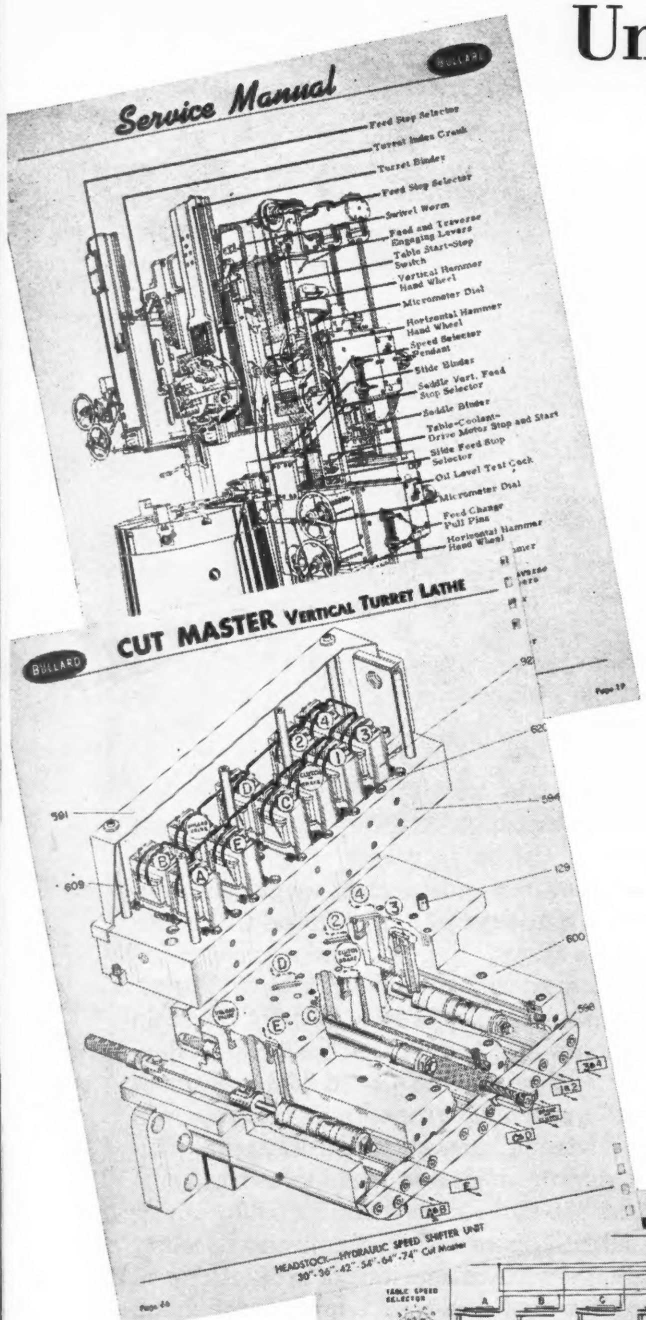
Answered by the International Nickel Co., Inc.
New York City

Generally speaking, the principal effects of the commonly used alloying elements in steel may be said to be as follows: Carbon improves wear resistance and increases strength and hardness, with consequent decrease in ductility. Chromium increases hardenability and improves resistance to oxidation. Cobalt increases strength at elevated temperatures and controls magnetic properties; it is used largely in high-speed tool steels and magnetic alloys. Copper increases corrosion resistance and strength slightly; above 0.3 per cent, other elements are present usually to retain copper in solution. Manganese increases hardenability. It may cause difficulty in heat-treatment because of quenching cracks and coarse grain size. Molybdenum increases hardenability; increases strength at elevated temperatures, particularly at 850 to 1100 degrees F.; and reduces temper embrittlement. Nickel improves ductility and toughness without sacrifice of strength; provides toughness at sub-zero temperatures; and improves casehardening properties. Silicon improves hardenabilty in small amounts, and impairs hardenability in large amounts (over 0.75 per cent). Tungsten increases strength at elevated temperatures; it is used principally in high-speed tool steels. Vanadium increases hardenability; controls grain size in heavy sections; and provides hard carbides in tool steels.

* * *

To help lengthen the life of machine tools, the National Production Authority's Office of Small Business has issued a pamphlet on lubrication materials and methods entitled "Lubrication of Machine Tools." Copies can be obtained by writing to Printing Services, Department of Commerce, Washington 25, D. C.

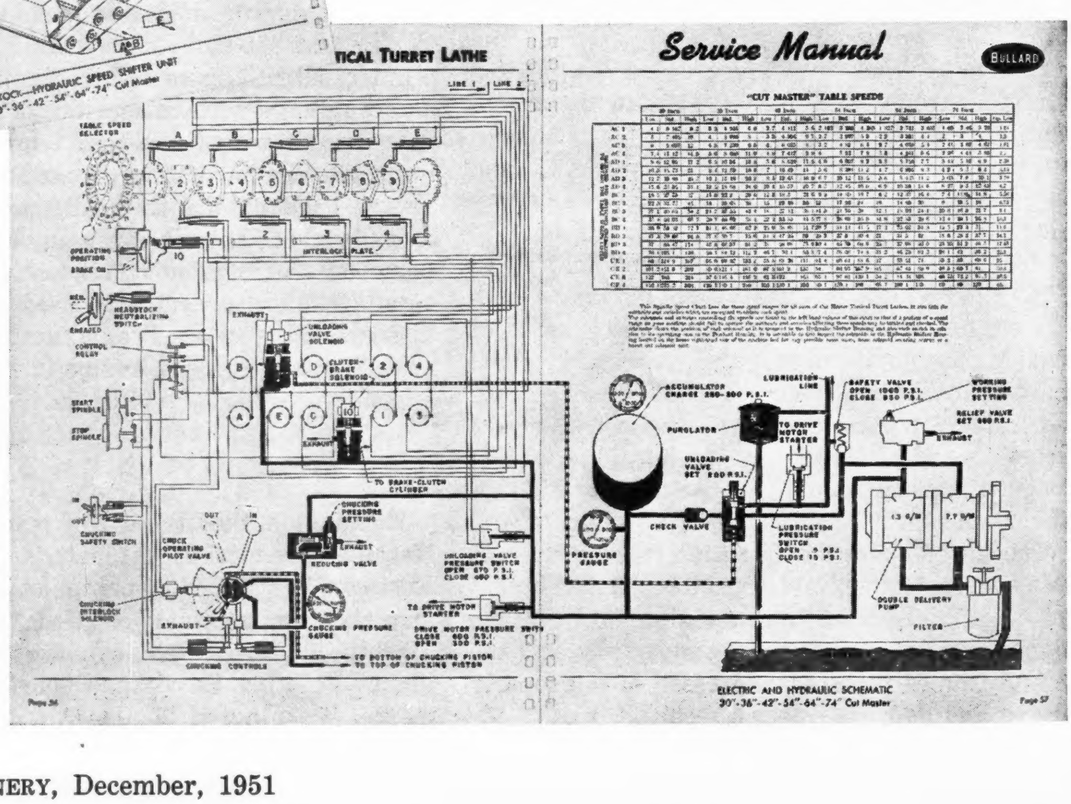
Unusual Bullard Manual



ONE of the most unusual service manuals to be developed in recent years has been prepared by the Bullard Co., Bridgeport, Conn. This manual covers all six sizes of the Cut Master vertical turret lathe, and shows completely the standardization of parts that are common to the several sizes of machines in the line.

Recently the United States Air Corps requested from suppliers of machine tools and other metal-working machinery service manuals with exploded-view illustrations to enable users of such equipment to easily disassemble machines for repairs or maintenance and to simplify reassembly. Feeling that the exploded-view type of manual is not suitable for machine tools, the Bullard Co. developed a manual which is remarkable for the clarity with which the complete machine and its various components are illustrated.

Both isometric and orthographic drawings are printed in two colors, and many illustrations are produced in four colors. These illustrations cover the complete machine, as well as details of major components, sub-assemblies, parts, and hydraulic and wiring diagrams. From the appearance of the illustrations, it is evident that the best possible drafting talent was employed. In illustrating such units as the feed bracket, for example, drawings similar to those shown on this page are provided. One drawing shows the bracket casting with all of the gears removed and only the shafts in place. The following drawing shows the casting with some of the gears in



Saves Maintenance and Service Time

position and includes cross-sectional views of others. A third drawing shows all of the gears and shafts in their respective positions.

In another case, a cut-away isometric view of the headstock is shown, followed by a cross-sectional drawing emphasizing the primary, secondary, and center shaft brackets. A combination cut-away and cross-sectional drawing of the headstock is then presented, showing the clutch and brake and shifter-rod settings. In other sections of the manual, phantom drawings indicate where hydraulic units and lines exist, and schematic diagrams are provided to show clearly where units of the hydraulic system tie in with the electrical system. A chart enables maintenance men to determine quickly which solenoids in the machine may not be functioning properly.

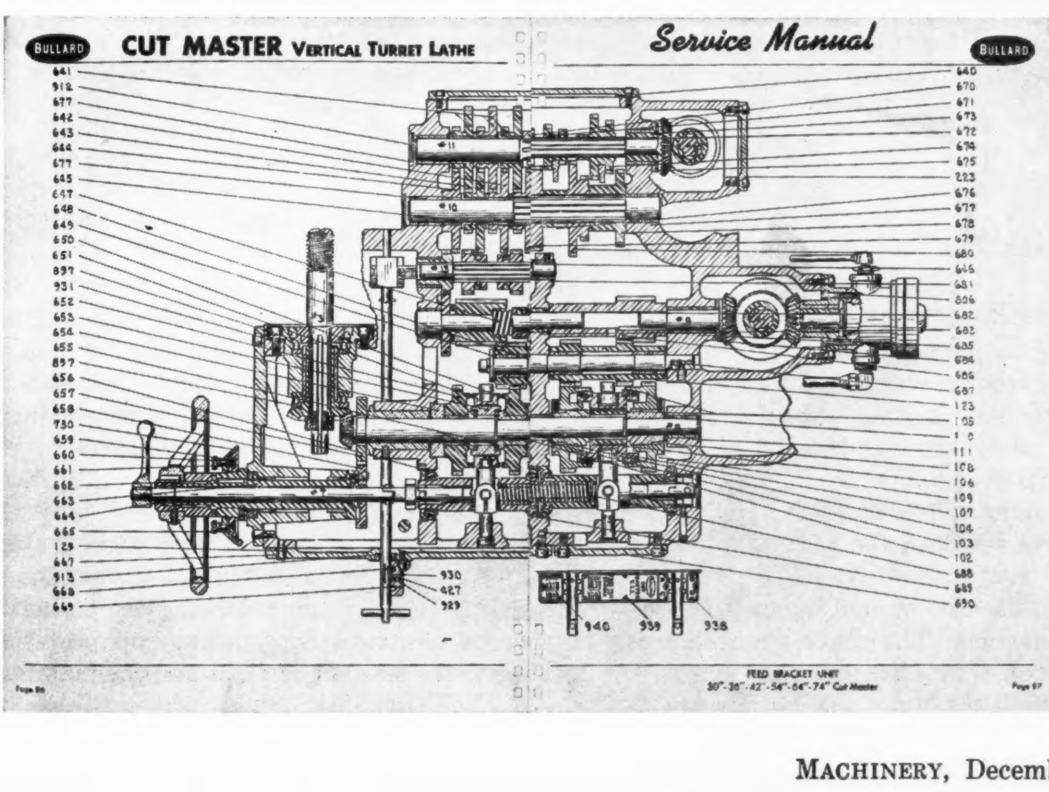
The text, written in a clear, concise manner, gives installation and maintenance instructions. These include illustrated descriptions of methods of lifting the machine with a crane, jacking and rolling on skids, leveling, etc. Instructions for machining angles without the use of special attachments, including illustrated examples, are given, and numerous charts are provided for English and metric thread cutting, drum scoring, and angular turning. Both an alphabetical and an illustration index are supplied.

The manual has been so successful that companies who have experienced a breakdown have been able to repair the equipment by merely conversing over the telephone with Bullard service men, instructions being given by the service man with reference to the book. Numerous concerns to which Bullard could not give immediate service have been able, with the assistance of this book, to dismantle the machine, completely rebuild it, and have it running again in a comparatively short time.

In the Bullard production department, the manual is found useful on the assembly floor and also in training new employes. Moreover, stock chasers are quickly able to determine where required parts are to be applied by reference to this book. Time-study men in the Bullard plant also make extensive use of the book, and in the engineering department, new draftsmen can easily locate and determine the application of various parts shown in their detail drawings.

The object of the Bullard Co. was to produce a book that was worthy of a comparativly expensive machine. An unusual type of wire binding was employed. Four circles of wire are located both at the top and the bottom of the page, with none in the middle, so that in instances where an illustration runs across two pages, there is no wire to interfere with the legibility. There are 180 pages in the book which have been produced at a cost of approximately $160 a page. Twelve thousand man-hours were involved in making the drawings alone.

Credit for the production of this useful manual, which is a copyrighted publication, is due to the co-authors Andy Lindmark and R. C. Bullard.



Engineering Problems Considered at Gear Manufacturers' Meeting

GEAR inspection; methods of calculating the beam strength of spur and bevel gears, as well as the bending stresses of spur gear teeth; and the heating of enclosed gear drives received especial attention at the semi-annual meeting of the American Gear Manufacturers Association, held at the Edgewater Beach Hotel, Chicago, Ill., October 29 to 31, inclusive. One of the highlights of the meeting was a symposium, at which a panel consisting of representatives of companies that make inspection equipment discussed the types of equipment built by their concerns and answered questions relating to gear inspection. The purpose of the symposium was to inform members about the kinds of instruments available for meeting current requirements and to consider suggested improvements in equipment.

The symposium held a morning and an afternoon session. The members of the panel were L. D. Martin, Eastman Kodak Co.; G. H. Sanborn, Fellows Gear Shaper Co.; R. T. Parsons, Van Keuren Co.; S. L. Crawshaw, Western Gear Works (moderator); G. L. Dannehower, High Precision Products Co.; B. F. Bregi, National Broach & Machine Co.; A. S. Beam, Vinco Corporation; C. R. Staub, Michigan Tool Co.; and Fred Bohle, Illinois Tool Works.

Two meetings were also devoted to a discussion of the Progress Report of the Gear Rating Coordinating Committee, of which R. P. Van Zandt of the Caterpillar Tractor Co. is chairman. The report was divided into three parts as follows: Proposed Practice for Beam Strength of Spur Gears; Proposed Practice for Beam Strength of Bevel Gears; and Discussion of Allowable Bending Stresses for Spur Gear Teeth. These proposed practices merely represent a start in the comprehensive task of developing formulas based on the present increased knowledge of gear engineering.

In his paper "The Thermal Problem of Enclosed Gear Drives," E. J. Wellauer, Assistant Chief Engineer, Materials and Research, The Falk Corporation, pointed out that the load carrying capacity of enclosed gear drives has been increased over a period of years by utilizing every possible advantage that can be secured by the use of higher strength materials, more accurate gear cutting and finishing methods, advanced bearing designs, and improved lubricants. However, these benefits have not been fully exploited in service because the so-called "thermal rating" has seriously limited the allowable horsepower to an extent ranging from 30 per cent of the catalogue listed ratios on small units to over 75 per cent of the listed ratios on large units. Such restrictions seem unwarranted for geared power transmitting devices that are universally recognized for their high efficiencies, and on this account, a research into the fundamental thermal problem for enclosed gear drives was made.

Mr. Wellauer's paper described an analysis of thermal dissipation, and considered the sources of developed heat, such as rotating bearings, meshing gear teeth, and circulating lubricant.

Plant Maintenance Conference to Cover Broad Field

PLANS for the third Plant Maintenance Conference, to be held concurrently with the Plant Maintenance Show at Convention Hall, Philadelphia, January 14 to 17, are said to call for the most intensive examination of maintenance problems ever undertaken. Thirty-four separate discussions will be conducted, and more than 100 experts will lead the panels.

Six general conferences, twenty-seven sectional meetings, and the annual banquet are included in the schedule. The general conferences will consider basic problems of all industry, while the sectional meetings will be devoted to specialized subjects of interest to particular industries. Among the general topics to be discussed will be "Maintenance Costs"; "Inspection Methods and Records for Preventive Maintenance"; "Planning and Scheduling Maintenance Work"; "Training Maintenance Workers and Supervisors"; and "Lubrication."

The sectional sessions will deal with project preparation; maintenance in plant buildings, chemical plants, and metal-working plants; maintenance of electrical equipment; and problems peculiar to the size of the plant and the maintenance it requires.

Indexing Jig for Drilling Cap-Nuts

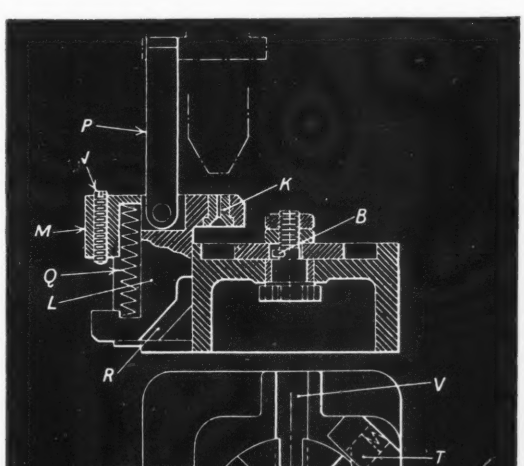
In the mass production of certain internal combustion engine accessories, it was required to manufacture large numbers of cap-nuts having an air-vent hole drilled through the cap and into the tapped hole. The vent-hole was to be drilled as a final operation on a cam-fed sensitive drilling machine. The fixture shown in the accompanying illustration, which can be adapted for either hand or hopper feed, was used with considerable success for this purpose.

Index-plate *A* is attached by means of key *B* and lock-nuts to the central spindle of the jig. The lower end of this spindle is milled to form ratchet *E*. The index-plate and spindle are free to rotate in the hollow body of the jig under the action of spring-controlled pawl *G*, which is carried in sliding bar *J*.

In the lower end of drill bushing *K* is a conical recess that fits over the cap of the nut to be drilled. The bushing is carried in slide *L*. This slide reciprocates in the body of the jig, and is retained by plate *M*, which carries stop-screw *N*. Link *P*, attached to slide *L*, engages the drilling machine spindle, so that when the spindle is moved up, the slide is pulled upward against the pressure of spring *Q*. At the lower end of slide *L* is a cam track *R* which engages a pin *S* that is carried in sliding bar *J*. The spring latch indicated at *T* engages the slots in the index-plate *A*.

To operate the fixture, a nut is inserted in slot *W* in the index-plate and the drilling machine spindle is lowered. On the return stroke of the spindle, slide *L* moves upward, causing pin *S* and sliding bar *J* to be drawn across the body of the fixture by the action of cam slot *R*. Pawl *G* thus engages ratchet *E* and imparts a clockwise rotation to the index-plate, carrying the nut to the drilling station. The amount of movement is controlled by adjustable stop-screw *N*.

The spindle is now fed downward for the drilling stroke, during which the cam slot and pin *S* cause the sliding bar to move back until the pawl engages the next tooth of the ratchet. Slide *L* is further depressed by the action of spring *Q* until the conical recess in the drill bushing engages the cap of the nut. The drilling stroke of the spindle is then completed. Each stroke of the drilling machine spindle produces a drilled cap-nut, which is carried around by the index-plate and delivered to a chute at the rear of the jig, as shown at *V*.



Jig that automatically indexes to bring a cap-nut beneath the drilling machine spindle. Drilled cap-nuts are ejected down chute (V)

* * *

National Metal Trades Association Elects New Officers

At the fifty-second annual convention of the National Metal Trades Association, held recently in Chicago, Ill., the following officers were elected: President, Charles S. Craigmile, president of the Belden Mfg. Co., Chicago; first vice-president, Earle S. Day, vice-president and general manager of the Collyer Insulated Wire Co., Pawtucket, R. I.; and second vice-president and treasurer, Norman L. Rowe, vice-president of the Ideal Roller & Mfg. Co., Chicago.

* * *

New Tocco "Economy in Production" Contest

The second "Economy in Production" contest sponsored by the Tocco Division of the Ohio Crankshaft Co., Cleveland, Ohio, has been announced. Contestants competing for the $3000 prize money ($1000 first prize, ten prizes in all) must submit descriptive articles dealing with actual installations of Tocco induction heating equipment and showing how production has been increased or costs reduced by these installations. Entry blanks for the contest, which closes June 1, 1952, can be obtained by writing to the Tocco Division, Ohio Crankshaft Co., Cleveland 1, Ohio.

* * *

In selecting a 5-H.P. electric motor for driving a machine, there are more than 1000 standard and semi-standard types from which to choose.

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER
Lester and Silver
Sales Management Engineers
New York and Philadelphia

Closing the Sale

A BUYER was recently describing his purchase of a sizable installation of new equipment. "I know Joe Taylor did a fine job and helped us," he said, "but Bill Mitchell came in with as good a proposition. He was crazy to get the order. I just could not turn him down. Some day we will make it up to Joe perhaps."

What was this buyer really telling me? That Joe Taylor, as a sales engineer, had done a good job right up to the time of closing. But Bill Mitchell had so influenced him that he could not resist giving him the order. Joe got sympathy all right—*perhaps* the buyer could make it up to him.

The most common weakness in engineering salesmen is that they cannot close the order. They do all the groundwork, but just cannot turn the trick when the decision is made.

Essentially buyers make decisions because, first, they get most for the dollar to be spent; and second, they like the salesman as a person. It's easy to say that closing ability depends on force of personality and the friendly hammer-blows of human influence. But it's a whole lot harder to explain how to acquire these attributes and skills. The solution all springs from understanding the human side of selling, and cultivating those characteristics that influence people and make them act the way we want them to.

Let us see what we do as we button up the proposition and drive toward a close. Let us see what must go on deep down in our minds and hearts. Then, with all objections met by reason, how can we impinge our personal influence in a friendly and persuasive way so as to get a favorable reaction?

1. Forget ourselves. Fix our attention completely on benefits to the prospect. Select those benefits which will mean the most to him. Don't give him just a jumble of reasons, but concise points that don't permit argument. Get so wrapped up in what we are going to do for the prospect that momentarily we don't think of what he can do for us.

2. Develop a deep personal belief—a conviction in the truth of our sales story. Without conviction, our words are only parrot-talk Without genuine conviction and the ability to make it felt, we are only saying—though not perhaps in words—that we don't care too much if the order is placed elsewhere.

3. Want the order—make this want known. All of us have hidden desires we don't make evident. In all forms of selling—of course at the right time—we must come out and say how anxious we are to get this particular order because we want the prospect to reap a harvest from the equipment. We are so sure that our service and our equipment will be the best answer to the prospect's problem that we burn with a desire to supply it.

4. Show genuine enthusiasm. Prospects are people. They are just like we are. They may have little enthusiasm, but enthusiasm is catching. Our job is to inject this into the prospect. By our enthusiasm we can make him enthusiastic. Any one of us attending a meeting or a play may approach it cold. The speaker or actor at first may mean nothing to us. Pretty soon he captures our mind and our heart. "Well, that fellow got me," we may exclaim after it's all over. Others on the platform or stage may feel enthusiastic, but they cannot transmit their enthusiasm by voice and action to the audience.

5. Create an atmosphere of obligation to us. Even a successful beggar, selling only sympathy, will make us feel obligated to shell out a quarter. How much more can a salesman—farthest from the beggar—make the prospect feel that he above all others deserves the business. To do this, he must establish the fact that his time and his effort, as well as that of his whole organization,

deserve not only recognition, but a decision favorable to him.

Remember Bill Mitchell who got the order. Though a good engineer, he knew the human side of selling. He made people like him and act on his desire. No one takes to a spineless personality, without force and well controlled personal influence. Only one of us can get a particular order. Will I be the one? So much depends on whether I am a good closer.

* * *

Fixtures for Clamping Thin-Walled Parts

In machining thin-walled parts having medium or large diameters, trouble is sometimes experienced from deformation of the work caused by clamping. The three clamping fixtures here illustrated have obviated this difficulty.

Fig. 1 is a boring chuck. The tubular part *W* is clamped by three arms, which force it against the hardened cone *A*, thus centering it. The chuck flange has an annular groove in which cone-shaped ring *A* is secured by three screws. Clamping and unclamping are effected by the knob *B*, which acts on plate *C*. The pressure is transmitted through three pins which bear on the plate *D* carrying the three clamping arms. When work is being inserted or removed, the clamping arms are partly rotated by turning knobs *E*.

Spring-loaded balls are provided in the bearings to insure that the arms will remain in any set position. Behind plate *D* is a helical spring,

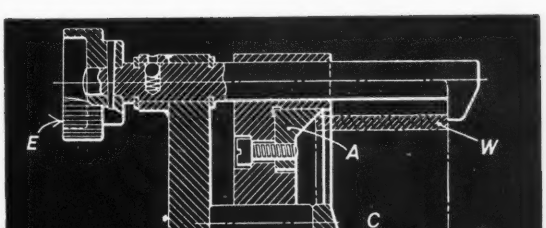


Fig. 1. Chuck for clamping thin-walled parts for an internal roughing operation

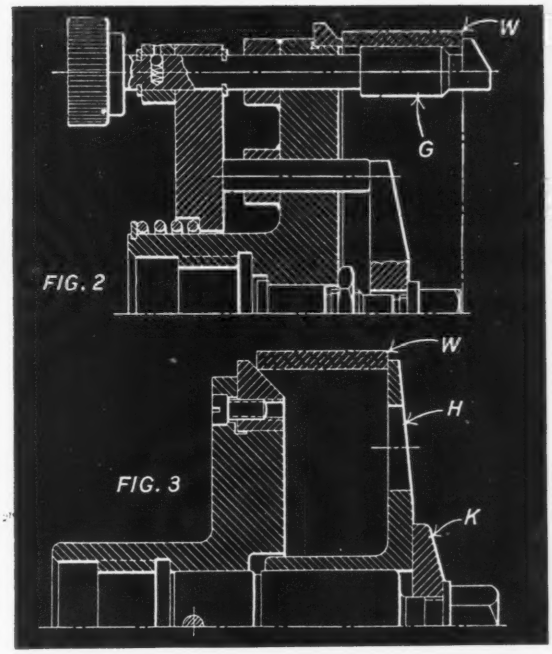


Fig. 2. Chuck for clamping thin-walled tubes for external machining operations. Fig. 3. Another chuck for clamping tubes for external roughing operations

retained by a snap-ring, which moves the clamping arms clear of the work when knob *B* is released. Screw *F* is secured by a ring-nut, and has a central hole to allow the escape of air when the chuck is mounted on the spindle nose.

If the work-piece to be chucked has been previously finish-machined on the outer diameter, the conical ring can be replaced with a plain abutment ring, as shown in Fig. 2. Accurately ground rings *G* are fitted to the clamping arms, thus providing three-point location to insure correct centering.

Another form of chuck for holding work for external operations is shown in Fig. 3. Here work *W* is centered by a cone and clamped by member *H*, which has a long bearing on the central bolt. Clamping is effected by means of a hexagonal nut and slotted plate *K*. For releasing the work, both plate *K* and member *H* are removed.

It is recommended that work-pieces to be held in the chucks shown in Figs. 1 and 3 should be slightly chamfered when the ends are faced to facilitate accurate centering. Both these chucks are intended for roughing operations, whereas the arrangement shown in Fig. 2 is suitable for finishing.

* * *

In 1950, shipments of lathes were valued at $79,500,000, which represents an increase of 28 per cent compared with 1949. Engine lathes accounted for 30 per cent of the total value.

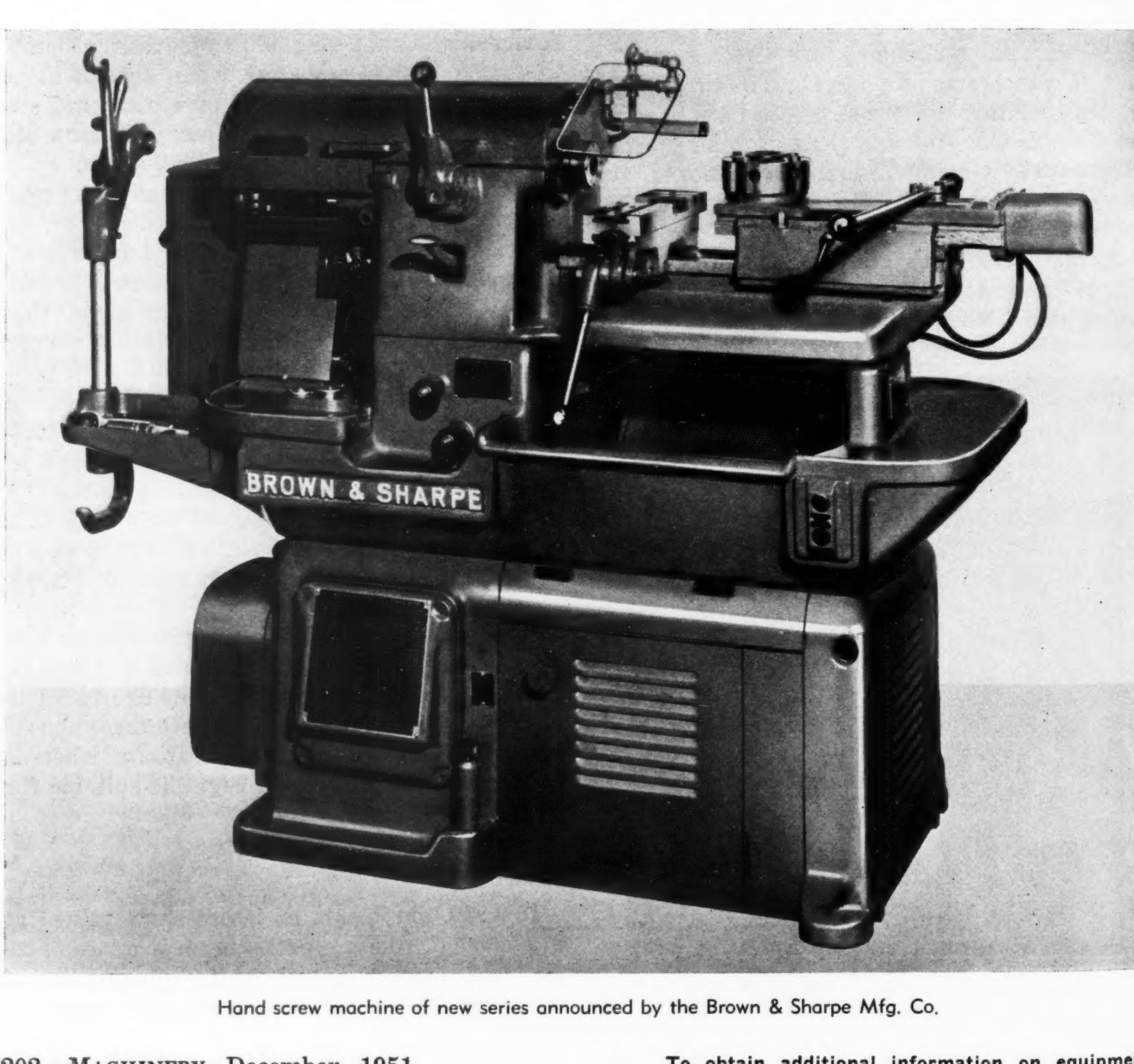
LATEST DEVELOPMENTS IN Shop

Brown & Sharpe Hand Screw Machines

The Brown & Sharpe Mfg. Co., Providence, R. I., has announced a series of three new hand screw machines designed to combine the outstanding features of its wire feed screw machines and automatics. All three machines—Nos. 00, 0, and 2—of the series have a full anti-friction bearing spindle, with positive chain drive at all speeds.

Only a short movement of the spindle control lever is required to obtain either high or slow speed or to stop the spindle. The high to low speed ratios of the two-speed combinations range from 1.6 to 1 up to 13 to 1. This range gives a total of 196 speeds. Pick-off gears conveniently located near the operating position permit quick changing of spindle speeds.

The driving mechanism is completely enclosed and automatically lubricated, as are practically all other mechanisms and bearing surfaces. Quick, convenient oper-



Hand screw machine of new series announced by the Brown & Sharpe Mfg. Co.

To obtain additional information on equipment described here, use Inquiry Card on page 233.

Equipment

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on Market

Edited by FREEMAN C. DUSTON

ation of the collet and feeding mechanism is provided by a trip-lever. There is an adjustable stop for each turret tool. All electrical equipment conforms to the "Machine Tool Electrical Standards."

The smallest of these new hand screw machines—the No. 00—takes stock up to 3/8 inch in diameter, and in some cases will handle stock 1/2 inch in diameter. Any length of feed up to 2 inches can be obtained by a single movement of the feeding mechanism, and greater lengths can be obtained by successive movements. The feeding movement of the turret slide permits turning any length up to 2 1/4 inches. Maximum distance from face of collet to turret is 7 inches; vertical distance from center of tool holes in turret to top of turret slide, 1 3/8 inches; swing over bed, 9 1/4 inches; and swing over cross-slide, 3 1/8 inches.

This machine has a speed range of 6050 to 50 R.P.M., and is driven by a 3-H.P. constant-speed motor, enclosed in the base by louvered guards. The turret has six holes, each 5/8 inch in diameter. The floor space required is 40 3/4 by 70 5/8 inches, and the weight about 2000 pounds.

The intermediate size (No. 0) machine takes stock up to 5/8 inch in diameter, and where the work permits it will handle stock 3/4 inch in diameter. A single movement of the feeding mechanism advances stock any length up to 3 inches. Successive movements of feed can be used for greater lengths. Movement of the turret slide permits turning any length up to 4 inches. Greatest distance from face of collet to turret is 12 1/2 inches; vertical distance from center of tool holes in turret to top of turret slide, 1 13/16 inches; swing over bed, 11 1/4 inches; and swing over cross-slide, 4 1/8 inches.

This machine has a speed range of 4230 to 35 R.P.M., and is driven by a 3-H.P. constant-speed motor. The turret has six tool holes, 3/4 inch in diameter. Floor space requirements are the same as for the No. 00 machine. The weight of the 0 machine is about 2275 pounds.

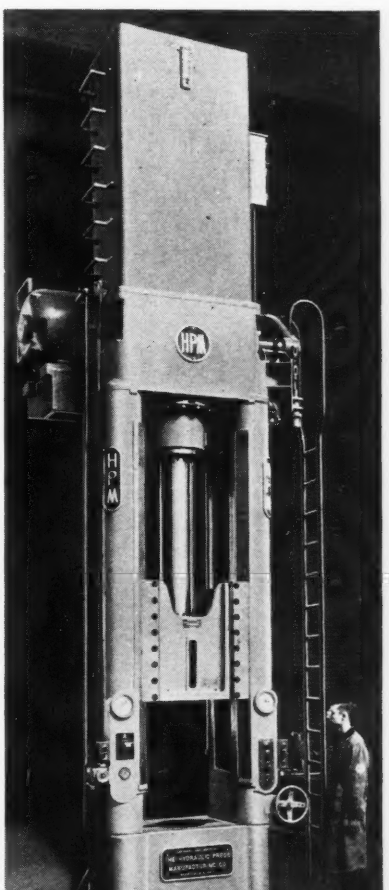
The No. 2 machine takes stock up to 1 inch in diameter, and where work permits, up to 1 1/4 inches in diameter. Stock can be advanced any length up to 4 inches by a single feeding movement, and greater lengths can be fed by successive movements. Greatest distance from face of collet to turret is 18 inches; vertical distance from center of tool holes in turret to top of turret slide, 2 1/16 inches; swing over bed, 12 1/2 inches; and swing over cross-slide, 5 inches.

Spindle speeds range from 3025 to 35 R.P.M. The turret has six tool holes, 1 inch in diameter. Turret slide has both manual and power feeds. Any one of five power feed rates (0.0015 to 0.010 inch per revolution of machine spindle) can be selected by a lever on front of the machine bed and engaged or disengaged by a lever near the pilot wheel, or automatically controlled by settings of turret stop-screws. The drive is by a 5-H.P. constant-speed motor. This machine requires a floor space of 42 by 103 inches, and weighs about 3145 pounds.

All three of the hand screw machines in the new series have front and rear stock supports; cross-slides that are adjustable along the bed; and a coolant system with reservoir in tank table. They are all adapted for economical production on short-run bar and second-operation work. 61

H-P-M Press Designed for Rapid Drawing of Cartridge Cases

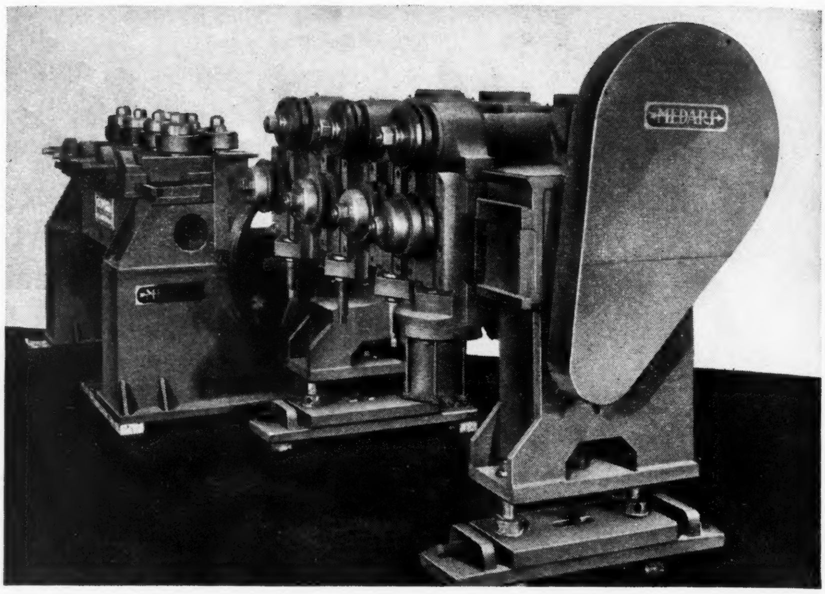
A 150-ton, deep-draw hydraulic press has been designed by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, to speed up the manufacture of cartridge cases to meet ordnance demands. This press is equipped with a 30- by 30-inch



Deep drawing press built by Hydraulic Press Mfg. Co. for producing cartridge cases

To obtain additional information on equipment described here, use Inquiry Card on page 233.

platen, has a 72-inch stroke, and provides the unusually high pressing speed of 215 inches per minute. It is driven by the "Fast Traverse" all-hydraulic power system. The high-speed cycles of this press comprise rapid advance to the work, automatic slow-down as the die contacts the work, and rapid return for the next cycle...62



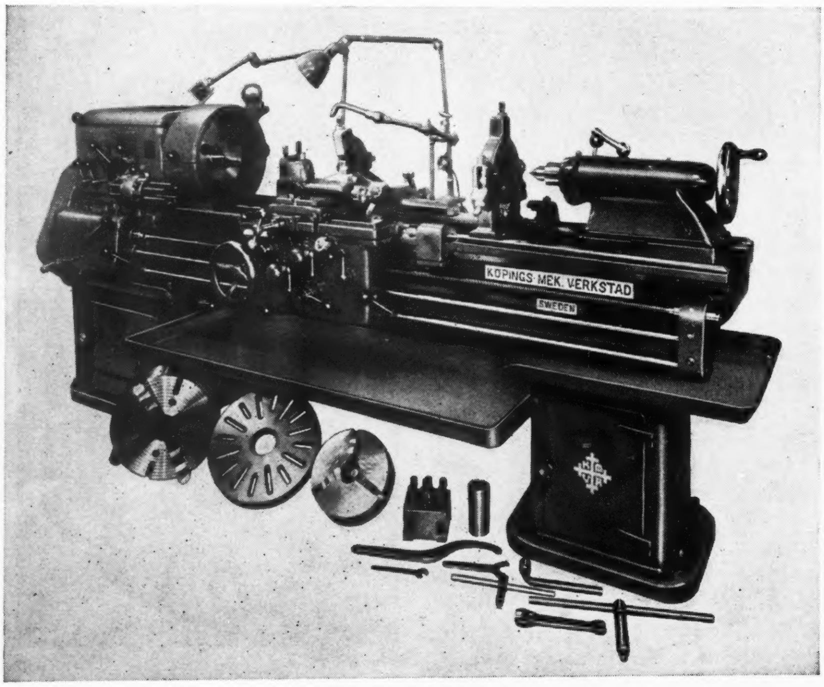
Two-plane shape straightening machine developed by the Medart Co.

Koping High-Speed Precision Lathes

The American Pullmax Co., Inc., Chicago, Ill., has been appointed exclusive sales representative in the United States for the Koping line of high-speed lathes manufactured in Sweden. This line will include 16-, 20-, 24-, 28-, 36-, and 40-inch sizes. Many features have been incorporated in these lathes to adapt them for tool-room and precision work, including disc type clutch design for smoother forward and reverse engagement. All shafts are mounted in roller type anti-friction bearings.

Eighteen spindle speeds are available on this lathe, and any one of forty turning and threading feeds can be selected without change of gears. The movement of a tumbler and lever give direct readings for pitch, longitudinal feed, and cross feed. It is possible to cut as many as 271 different threads in both the metric and American Standard systems of screw threads.

The faceplate operates behind a shield, which protects the operator from flying chips and cutting fluid. Certain models are also equipped with electrical gages that indicate the amount of strain imposed on the machine by the turning operation. Several accessory parts are available for use on this machine, including an indexing turret type head and other tool-holding devices. 63



Koping high-speed lathe introduced in this country by the American Pullmax Co., Inc.

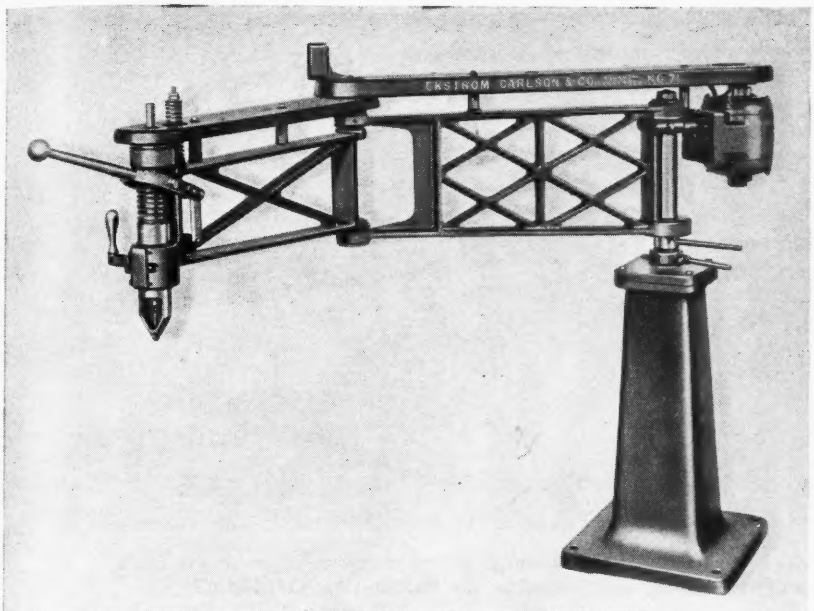
Medart Two-Plane Shape Straightener

The advantages of quick, easy set-up inherent in the overhung-roll type of shape straightener and the control of bending stresses possible in a straightener with variable centers have been combined in a new machine developed by the Medart Co., St. Louis, Mo. This machine is a two-plane type with overhung variable-center rolls.

The variable center rolls permit a high degree of versatility in adjusting bending spans and enable a virtually unlimited range of shapes and sizes to be handled. In addition, the movable roll housings permit adjustments to be made that prevent the overloading of bearings and assure much greater accuracy in straightening operations.

The bottom rolls can be moved directly under the top rolls to permit cross-rolling for reforming the cross-sections of distorted extrusions or other shapes simultaneously with the straightening action. Also the top and bottom rolls, when set in pairs one over the other, serve as additional pinch-feed rolls which can be employed to furnish extra traction for shapes that are difficult to straighten. Another feature of the machine is the provision for easy removal and interchanging of rolls, which is accomplished by simply taking off a lock-nut at the end of the roll shaft....................64

To obtain additional information on equipment described here, use Inquiry Card on page 233.



Radial-arm drill recently added to the line of Ekstrom, Carlson & Co.

Ekstrom, Carlson Radial-Arm Drills for Aircraft Industry

Ekstrom, Carlson & Co., Rockford, Ill., announce that they are now manufacturing 30-inch and 71-inch radial arm drills for use in the aircraft industry. First brought out during World War II, these units are designed for fast, light drilling, and are equally adapted for single piece and production run work.

Four types of each of the two sizes are again available. The Type A machine is provided with a large nut for mounting the complete unit on a table or stand, and is intended for use at a fixed height only, no provision being made for vertical adjustment. The Type B machine embodies a threaded post and support bracket for mounting the unit on a table or stand, and can be vertically adjusted up to 6 inches. Type C is identical in construction to Type B, except that it comes equipped with a cast-iron base.

All of these types have a spindle assembly which slides within an outer sleeve. The outer sleeve is fitted with the desired diameter drill bushing. Location of the spindle and the actual drilling operation are accomplished with the same lever; however, an extra handle is provided for two-handed operation if necessary.

The Type D radial-arm drill can be furnished with any of the three mountings described. It differs from the other types in that there is no outer spindle sleeve, the entire spindle assembly being actuated manually with a four-spoke hand-lever by a rack and pinion arrangement. An adjustable coil spring is provided to counterbalance the down stroke and facilitate rapid return of the drill spindle to the upper position. A side-mounted auxiliary handle is used only for positioning the spindle prior to the actual drilling operation.

Standard spindle speeds for the Type D drills are 2500 and 4000 R.P.M.; but these can be modified, if necessary, to suit the buyer. All models except the Type D drills can be supplied with a gravity-feed drill lubricating system for fast drilling in metals.........65

Airco "Travograph" Gas Cutting Machine

The No. 50 "Travograph" here illustrated is a recent addition to the line of gas cutting machines made by Air Reduction Sales Co., Division Air Reduction Co., New York City. The heavy-duty pantograph type precision gas cutting machine can be guided by a manual, magnetic, or electronic tracer. It will cut a wide variety of shapes from steel plates, slabs, billets, and forgings, and can be used for the economical cutting of either one or a few parts, or the quantity production cutting of identical parts.

The "Thym-o-trol" - controlled carriage-drive motor unit is self-contained, and provides stepless, accurate variations in carriage speeds from 2 to 168 inches per minute. The carriage remote con-

"Travograph" gas cutting machine placed on the market by the Air Reduction Sales Co.

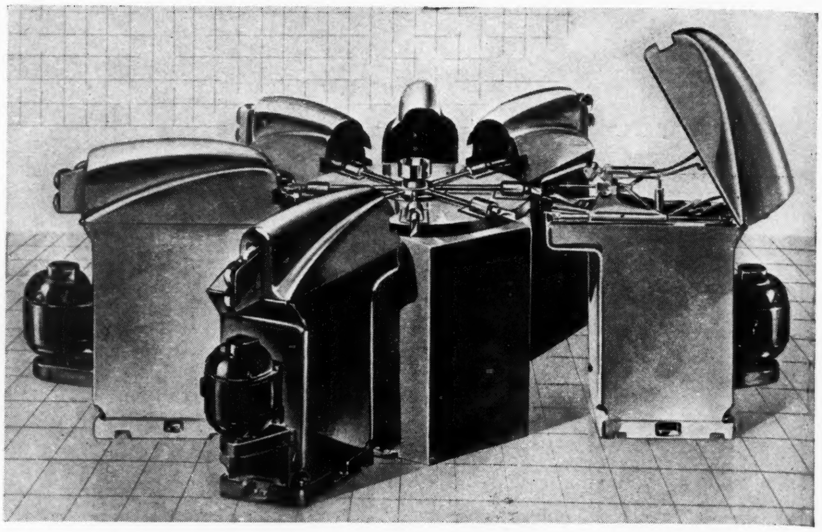
To obtain additional information on equipment described here, use Inquiry Card on page 233.

trol box can be mounted on the operating bar, together with the remote controls for the gas distribution system and other auxiliary equipment, to provide maximum operating convenience.......66

Micro-Lap Equipment for Finishing Jet-Engine Blades and Buckets

The Murray-Way Corporation, Birmingham, Mich., has developed an automatic precision polishing process known as "Micro-Lap." The new equipment, while designed particularly for the fast, accurate, and economical microsurfacing of jet-engine blades and buckets, has a wide range of other applications.

The "Micro-Lap" jet-blade installations are eight-station, hydraulically indexed units. The number of stations may be varied to suit requirements. The heads are mounted on floor bases, and operate continuously with no pause for indexing. The polishing jaws open automatically to receive and release the work. The indexing table carries no weight except that of the blade-holding fixtures and the blades, a feature that reduces maintenance and wear.



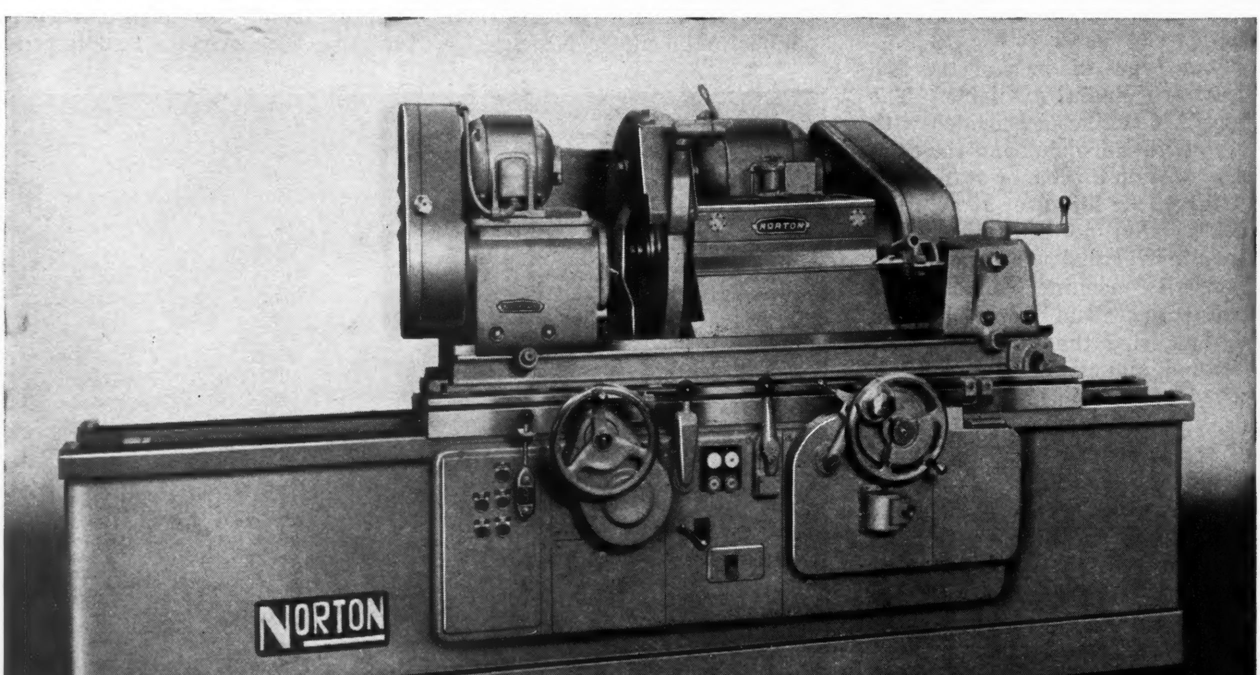
Automatic precision polishing machine for jet-engine blades developed by the Murray-Way Corporation

Successively finer grits under flood lubrication provide a finish of 3 to 4 micro-inches r.m.s. in a six-second cycle. Cycle time and individual station dwell times are fully adjustable to meet job requirements. The head stroke can also be changed for longer or shorter blade lengths.

In most cases, it is possible to micro-finish the fillet in the same operation. The "Micro-Lap" heads apply a longitudinal polishing action suited to this work.........67

Norton Cylindrical Grinding Machine

Light cylindrical work requiring up to 18-inch swing can be ground rapidly to extremely fine limits of accuracy and finish on a new machine brought out by the Norton Co., Worcester, Mass. This

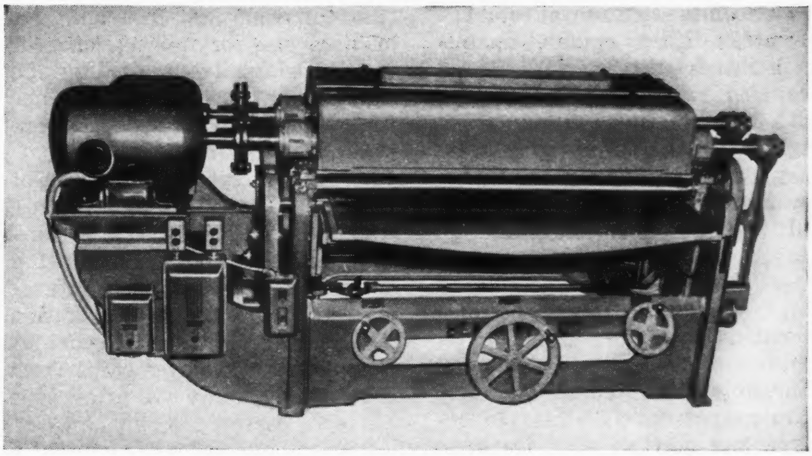


Cylindrical grinding machine developed by the Norton Co. for rapid handling of light work

To obtain additional information on equipment described here, use Inquiry Card on page 233.

Type LCTU machine is made in six capacities for handling work from 18 to 120 inches long, and is available in plain or semi-automatic models. It is especially designed for rapid production with minimum effort, incorporating such features as pre-set truing and grinding speed, "click-count" wheel-feed indexing, automatic work rotation, and coolant-flow control.

The wheel-spindle unit is of rugged design, with long full bearings which enclose the major portion of the spindle and keep it on a fixed center line under all loading conditions. Special attention has been given to simplifying the maintenance of electrical controls and other parts. 68



Precision surface sanding machine developed by the Beach Mfg. Co.

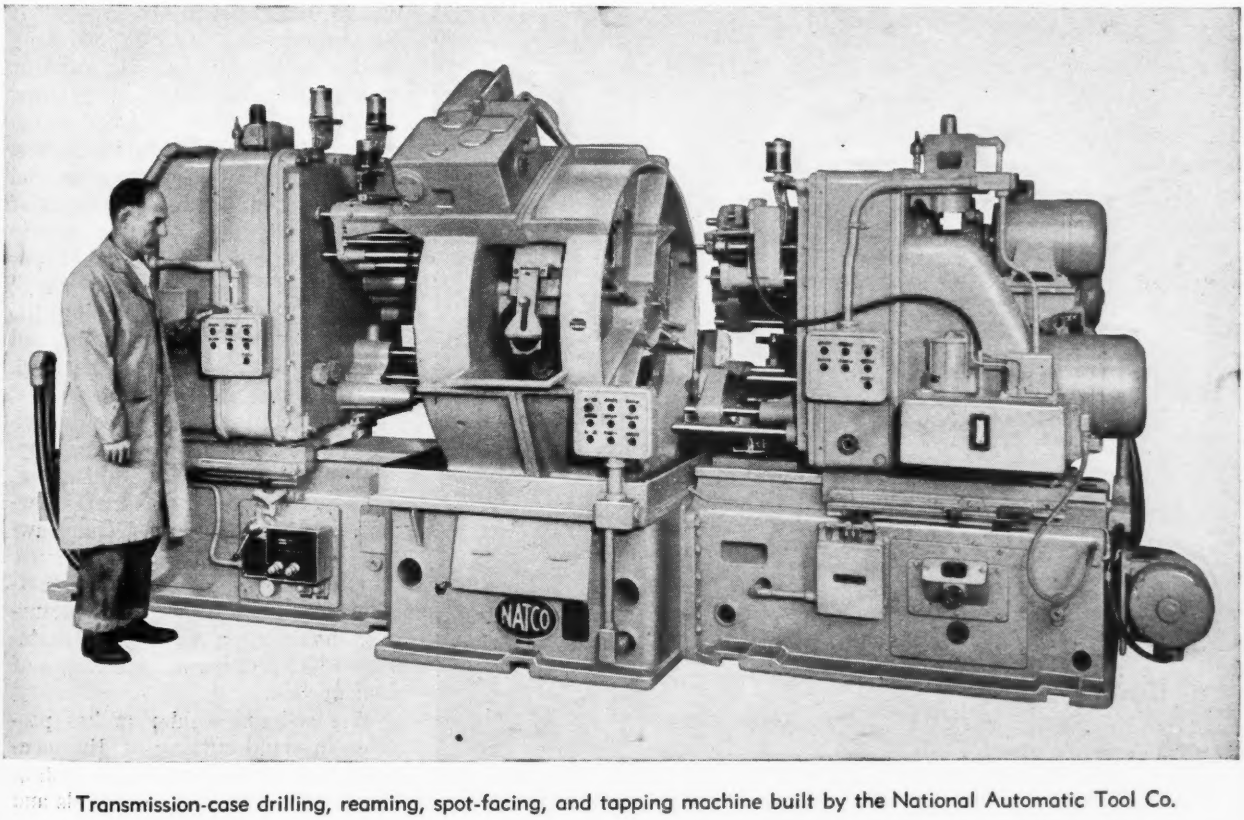
Beach Precision Drum Type Sander

The sanding machine shown in the accompanying illustration is designed to finish metal, wood, or plastic surfaces to close tolerances. This machine is built by the Beach Mfg. Co., Montrose, Pa., and is designated the No. 9 precision sander. It will handle material ranging from 1/32 inch to 6 inches thick and up to 54 inches wide.

Ground steel rolls are located directly under the abrasive drums to support the material and assure a uniform surface over the entire sheet. Two drums are regularly furnished with the machine. These sanders are available in 24-, 30-, 38-, 42-, 48-, and 54-inch sizes...69

Natco Machine for Drilling, Reaming, Spot-Facing, and Tapping Transmission Cases

The National Automatic Tool Co., Richmond, Ind., has recently built a combination four-way horizontal and angular type machine for drilling, reaming, spot-facing, and tapping transmission cases. This machine consists of horizontal floor type Natco units with fixed-center gear-driven heads; auxiliary reversing drive tapping units; and automatic indexing trunnion type work-holding fixture. It drills ten holes, chamfers four holes, reams and spot-faces one hole, reams one hole, reams and spot-faces two bosses, and taps eight holes in eighty-five transmission cases per hour.



Transmission-case drilling, reaming, spot-facing, and tapping machine built by the National Automatic Tool Co.

To obtain additional information on equipment described here, use Inquiry Card on page 233.

The units contain a total of seventeen drilling spindles mounted in anti-friction bearings. There are also eight tapping spindles with individual lead-screws, floating tap-holders, and a tap lubrication system. One single-spindle, reversing, motor-driven tapping unit is mounted angularly and arranged with hydraulic traverse. One "Holeunit" equipped with a single-spindle drill head is also mounted at an angle. One left-hand horizontal unit and the "Holeunit" mounted at an angle have automatic time delayed reverse and positive stop features. The machine has hydraulic feed, and weighs about 15 tons. 70

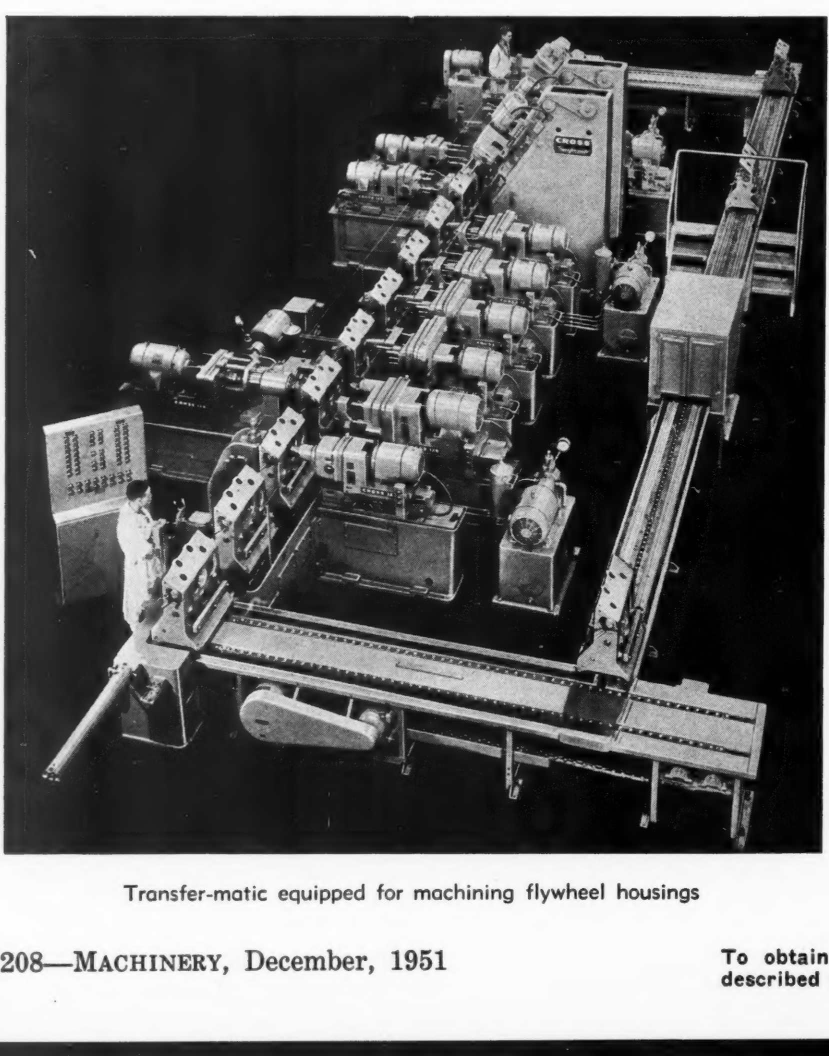
Transfer-matic for Machining Flywheel Housings

Flywheel housings are machined completely, except for the grinding of three faces, on a new Transfer-matic machine built by The Cross Company, Detroit, Mich. The automatic part transfer mechanism, and other features incorporated in the machine make it possible for only two unskilled operators to produce 138 flywheel housings per hour. The machine has thirteen stations—one for loading, one for milling, one for rough-boring, six for drilling and chamfering, two for tapping, one for finish-boring, and one for unloading.

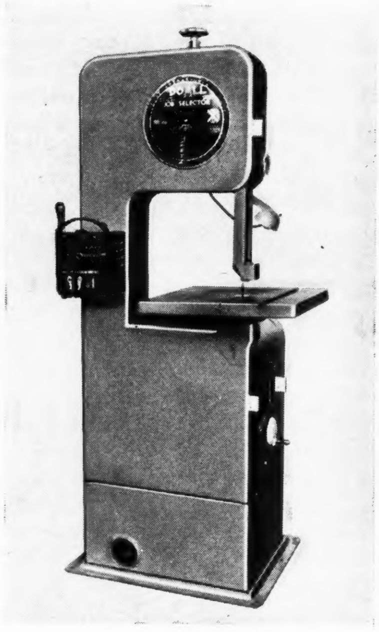
A special feature is the use of palletized work-holding fixtures, which hold the parts securely during operations and while moving between stations. These fixtures are returned to the loading station automatically by a conveyor. A cleaning unit removes chips from the fixtures, and a vibrating type conveyor carries the chips away.

The machine is equipped with a "Toolometer" to control tool life and automatically stop operation when the tools need resharpening. This feature, combined with preset tools to speed changing and eliminate machine adjustment, is said to result in less "down" time and greater production.

Other features include hardened and ground ways, hydraulic feed, automatic lubrication, and construction conforming to J.I.C. standards with stranded wire installation. The machine is composed of standard Cross subassemblies to facilitate maintenance, reduce "down" time, and permit changes in part design. 71



Transfer-matic equipped for machining flywheel housings



Do-All bandsaw adapted for a wide range of light bandsawing, filing, and polishing operations

DoAll Bandsawing Machine

A low-cost, light-duty bandsawing, filing, and polishing machine of unit welded steel construction has been brought out by the DoAll Co., Des Plaines, Ill. This Model SFP machine has a 16-inch throat and a capacity for sawing work up to 12 inches in thickness. It is designed to provide both high and low speed ranges without changing belts, pulleys, or motors. Stepless variation of speed is obtained by means of the handwheel control and two-speed geared transmission within the ranges of from 50 to 300 feet per minute and from 860 to 5200 feet per minute. This wide speed range permits the user to employ the correct speed for the type and thickness of metal being handled, and prolongs tool life.

The machine is said to be exceptionally versatile, being capable of conventional metal sawing, high-speed non-ferrous metal sawing, and light-gage friction sawing. It is especially suited for use in experimental and model departments and for light manufacturing involving a variety of materials that require a wide range of tool speeds.

A saw-band welder makes possible internal cutting of die openings and similar work, including the duplication of special tools and

To obtain additional information on equipment described here, use Inquiry Card on page 233.

machine parts. Such standard DoAll features as the job selector dial and "Speedmaster" drive are also included. A handwheel-controlled automatic power feed with pedal release can be supplied if desired, along with a wide assortment of guides and attachments. Saw bands up to 1/2 inch wide, file bands 1/4, 3/8, and 1/2 inch wide, and 3/4-inch polishing bands can be used. 72

Double-Belt Jet-Blade Polishing Machine

Bucket blades for jet engines and similar work can be readily ground and polished by the off-hand method on a new double-belt grinding and finishing machine introduced by the Production Machine Co., Greenfield, Mass. This machine uses abrasive or felt belts for performing off-hand grinding, finishing, and polishing operations. It is equipped with extended housings for accommodating platen rolls up to 4 inches in width, and ball-bearing spindles for contact wheels up to 1 inch in width by 3 inches in diameter.

The spindles of the machine are located at a convenient working level, and permit a 180-degree "wrap" of abrasive or felt belt around the contact wheel. The wheels are formed to suit the contour of the various types and forms of blades to be ground. The machine is available in both duplex and single types. If work requires the use of two belts having different grits, the duplex machine can be easily equipped to handle the job. Belts up to 4 inches wide by 115 inches long, running at speeds as high as 5000 surface feet per minute, can be used on this machine. 73

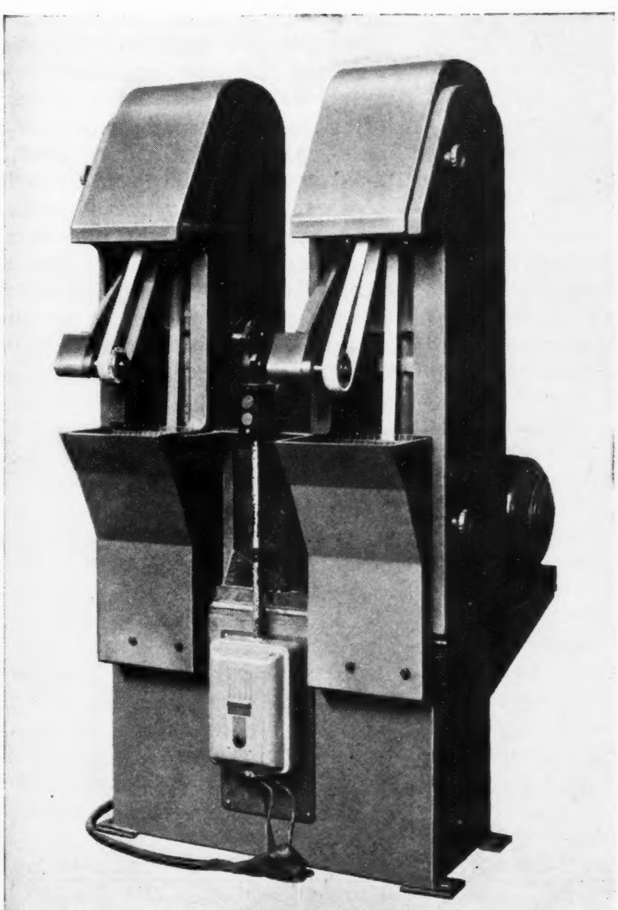
Bliss Gap Type Welding Press

A new gap-frame press for use with welding fixtures in the mass production of spot-welded assemblies has been developed by the E. W. Bliss Co., Canton, Ohio, in cooperation with a large automotive manufacturer. The gap style frame permits conveyor feeding from side to side and makes the work accessible from either the front or the back of the machine.

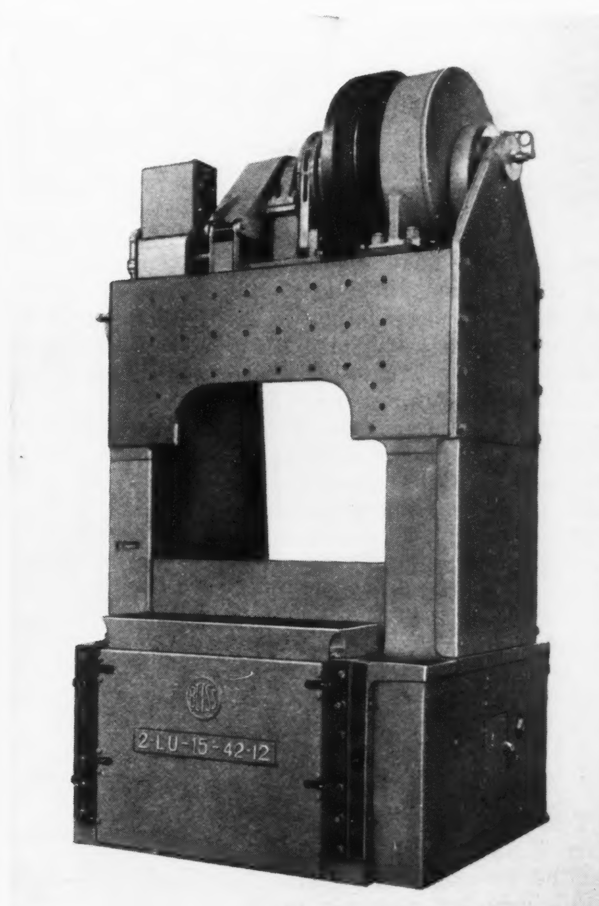
The slide is located in the lower portion of the press, and the work is done on the upward stroke. Parts to be welded are laid on the lower "die," which contains welding tips, and are moved up into contact with fixed welding tips attached to the upper part of the press. The slide dwells in the upper position, holding the parts in contact with the electrodes until welding is completed.

The pneumatic friction clutch, flywheel, and motor are located at the top of the press, where they are readily accessible. The drive-shaft is connected by a long eccentric rod to the slide-actuating mechanism in the lower part of the machine. This mechanism is enclosed to protect it from dirt and prevent damage.

The work stroke is adjustable,



Duplex machine developed by Production Machine Co. for grinding and polishing jet engine blades



Gap type welding press for spot-welded assemblies placed on the market by the E. W. Bliss Co.

To obtain additional information on equipment described here, use Inquiry Card on page 233.

and the shut height is the same for all adjustments. The operating cycle is divided into thirds—120 degrees for the up stroke, 120 degrees for the dwell, and 120 degrees for the down stroke. Each portion of the cycle takes a fraction of a second. The machine can be started and stopped at any point in the cycle under load. Slide widths on present models range from 42 to 84 inches, with a depth of 12 inches for all widths. Slides of larger or smaller dimensions can be built to order. 74

"Cawi-Spiral" Twist Drill Grinding Machine

Two- and three-lip twist drills from 0.078 to 1 inch in diameter can be ground to an unusually high degree of accuracy in the new "Cawi-Spiral" machine shown in Fig. 1, according to the Kurt Orban Co., Inc., New York City, who is importing the new machine from Western Germany.

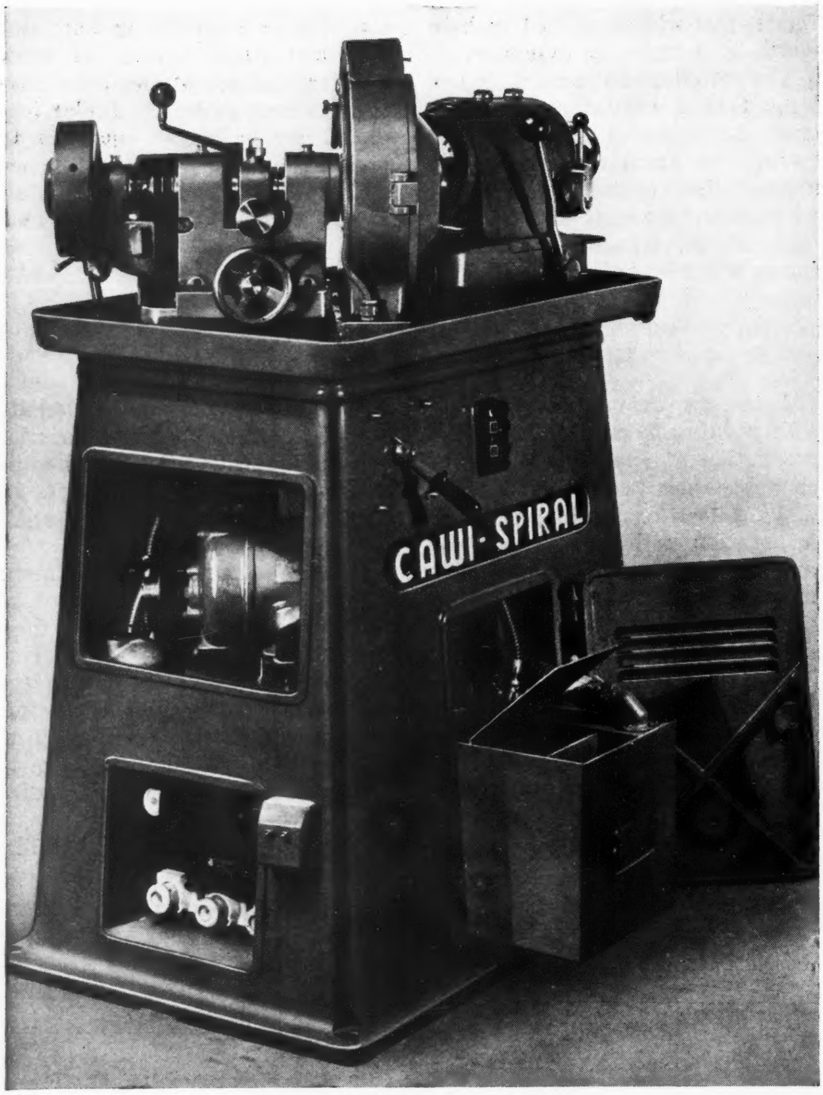


Fig. 1. "Cawi-Spiral" twist drill grinding machine introduced in this country by Kurt Orban Co., Inc.

The accuracy of this machine is made possible by a patented planetary drive gear system, the operation of which is shown diagrammatically in Fig. 2. For each revolution of the drive-head, a two-lip drill makes 1 1/2 revolutions on its own axis. For three-lip drills, the ratio is 1 1/3 to 1. With this arrangement, the cutting lips are ground in sequence each time the drill revolves in contact with the grinding wheel. This results in true concentricity of the lips with the axis of the drill body, and insures that the lips will be ground exactly alike.

Only two chucks are needed to handle drills from 1/32 to 1 inch in diameter. One chuck takes drills from 1/32 to 5/16 inch in diameter, and the other takes drills from 5/16 to 1 inch in diameter. Chucks are easily interchanged in less than a minute, and are opened and closed by a turn of the hand, no auxiliary tools being needed. The point angle is adjustable from 90 to 150 or from 60 to 180 degrees.

The use of the "Cawi-Spiral" method of grinding is said to result in longer drill life, with less need for resharpening; closer tolerances on drilled holes, which often eliminates the need for reaming; increased drilling speeds; and decreased vibration in drill presses. Pointing of carbide twist drills and grinding of a normal or increased lip relief angle and a short land with minimum relief at the cutting edges are accomplished in a single operation in the new grinder. 75

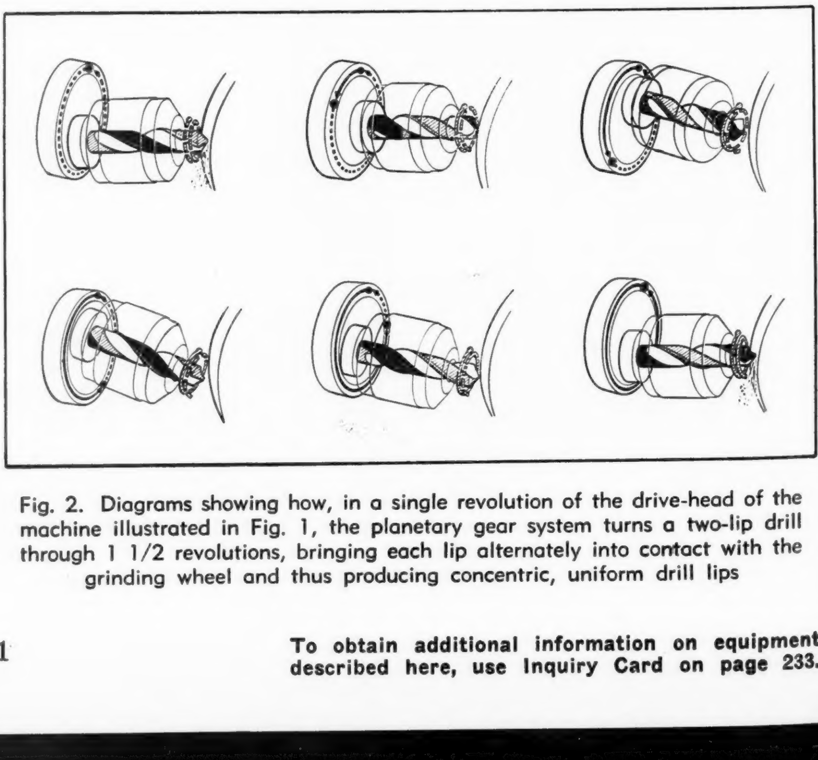
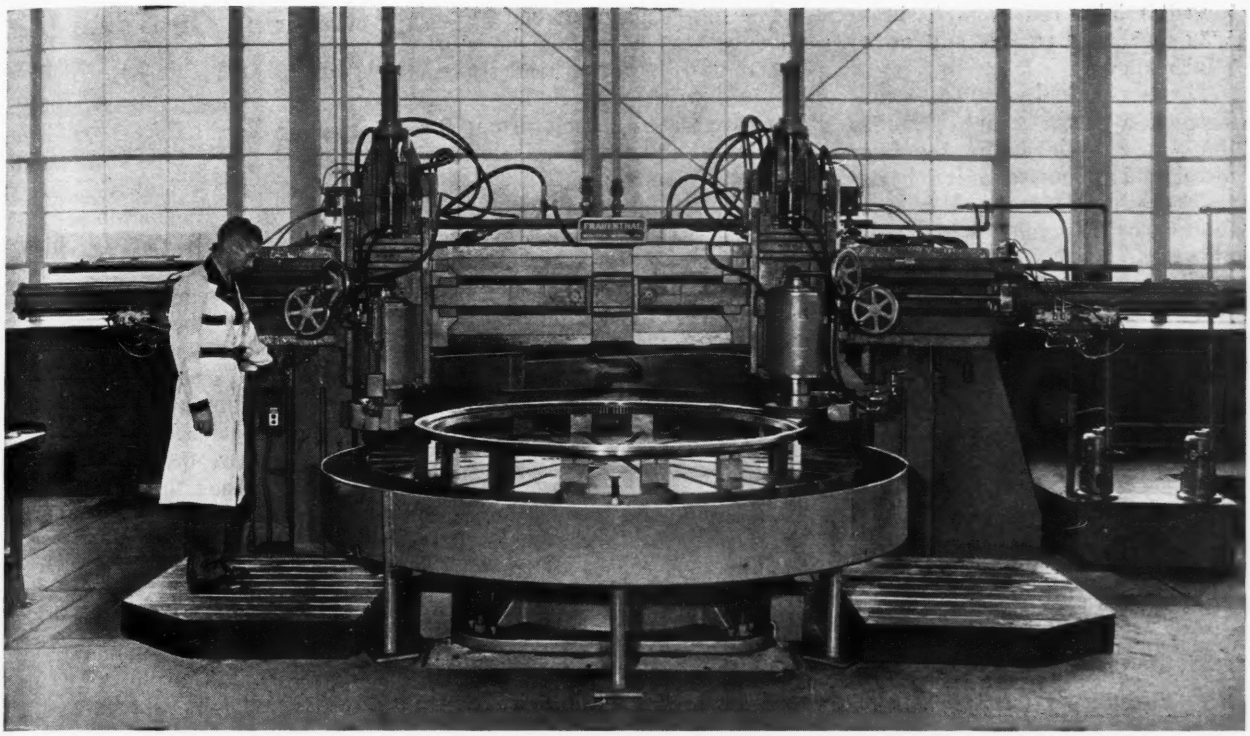


Fig. 2. Diagrams showing how, in a single revolution of the drive-head of the machine illustrated in Fig. 1, the planetary gear system turns a two-lip drill through 1 1/2 revolutions, bringing each lip alternately into contact with the grinding wheel and thus producing concentric, uniform drill lips

To obtain additional information on equipment described here, use Inquiry Card on page 233.



Double-head "super-precision" grinder built by A. Harold Frauenthal, Inc., for armament work

Frauenthal Double-Head Precision Grinders

A double-head "super-precision" grinder having a table 100 inches in diameter has recently been built by A. Harold Frauenthal, Inc., Muskegon, Mich., for use in a defense plant. This machine is one of the latest of the company's 2200 series grinders, which are made in four different table sizes of 100, 120, 130, and 140 inches diameter. These four sizes of machines have swing diameters of 120, 130, 140 and 150 inches. All are regularly made with a height of 20 inches under the rail, but this height can be varied to suit the customer's requirements.

The machines in this series have a worm type table drive. The grinding wheel spindles are driven by 7 1/2-H.P. direct-connected motors. The minimum length of the hydraulically actuated vertical stroke is 1 1/4 inches, and the maximum length 8 inches. Minimum and maximum travel speeds with hydraulic actuator are 7 and 120 inches per minute. The maximum vertical travel of the spindle with feed-screw is 20 inches.

The length of the hydraulically actuated horizontal stroke ranges from 1 1/4 to 36 inches. Maximum horizontal travel of the spindle with feed-screw is 18 inches. The maximum horizontal spindle travel with the hand and hydraulic feed is 49 inches. The range covered by the horizontal actuator is any 36-inch cycle within the total 49-inch range. Table speeds vary from 2.25 to 13.51 R.P.M., or can be furnished to suit requirements.

The four different sized machines in the 2200 series have minimum distances between center line of right-hand or left-hand wheel-spindle head and center of table of 12, 17, 22, and 27 inches. Maximum distances between center line of right- and left-hand wheel-spindle heads are 127, 137, 147, and 157 inches. All four sizes have a height of 8 feet 10 inches above floor level. The smallest machine requires a floor space of 21 feet 6 inches by 10 feet 7 inches, and the largest, 24 feet 2 inches by 12 feet.

These machines are especially adapted for extremely accurate work in grinding gun mounts, ordnance, and aircraft equipment...76

"Fillerweld" Gas-Shielded Arc-Welding Equipment

A new device designed to speed alloy-metal welding in applications where filler metal must be added has been announced by the General Electric Co., Schenectady, N. Y. This equipment, used with gas-shielded arc-welders, allows the operator to start and stop the automatic continuous flow of filler metal by means of a finger-switch without breaking the arc. This results in a smoother, faster weld.

The "Fillerweld" equipment consists of two main elements—the torch or gun and a mechanical power unit. The gun is basically a manual water-cooled inert-arc tungsten holder to which has been added a control switch and a gear assembly for pulling the filler metal from the spool to the arc through the gun. The gun, rated at 250 amperes, accommodates

General Electric "Fillerweld" automatic wire-feed device for gas-shielded arc-welders

To obtain additional information on equipment described here, use Inquiry Card on page 233.

tungsten filler rod from 0.040 to 5/32 inch in diameter and up to 7 inches long.

The mechanical power unit consists of a motor which provides the power for drawing the filler metal; a Thy-mo-trol unit for controlling the motor; and a spool that holds the filler wire. This unit is mounted on a portable platform, and can be moved easily from job to job.

The new equipment can be applied to best advantage on stock less than 3/16 inch thick. It can be used with a G-E Type WP inert-arc welding transformer for welding aluminum, magnesium, or beryllium copper; or with a G-E Type WD-4150 or WD-4200 for welding stainless steel, copper, Inconel, steel, and other weldable alloys. Either argon or helium can be used with the equipment. 77

Centerless Grinding and Finishing Machine Using Abrasive Belts

A heavy-duty, centerless grinding machine capable of removing large amounts of materials at fast feeding speeds, and at the same time maintaining close tolerances, has been brought out by the Production Machine Co., Greenfield, Mass. This machine, shown in Fig. 1, differs from the conventional type centerless grinder in that it employs abrasive belts in place of hard wheels for both cutting and feeding members, as illustrated in Fig. 2.

The use of a belt as a feeding unit offers several distinct advantages over a wheel. The belt maintains constant contact with the work at all feeding angles, and eliminates the need of dressing when either the feeding angle or the size of work is changed. This feature reduces set-up time to a minimum. The cutting belt is 9 inches wide by 168 inches long, and runs over the contact wheel and idler pulleys in a triangular arrangement. This design reduces floor space requirements, as compared with conventional designs.

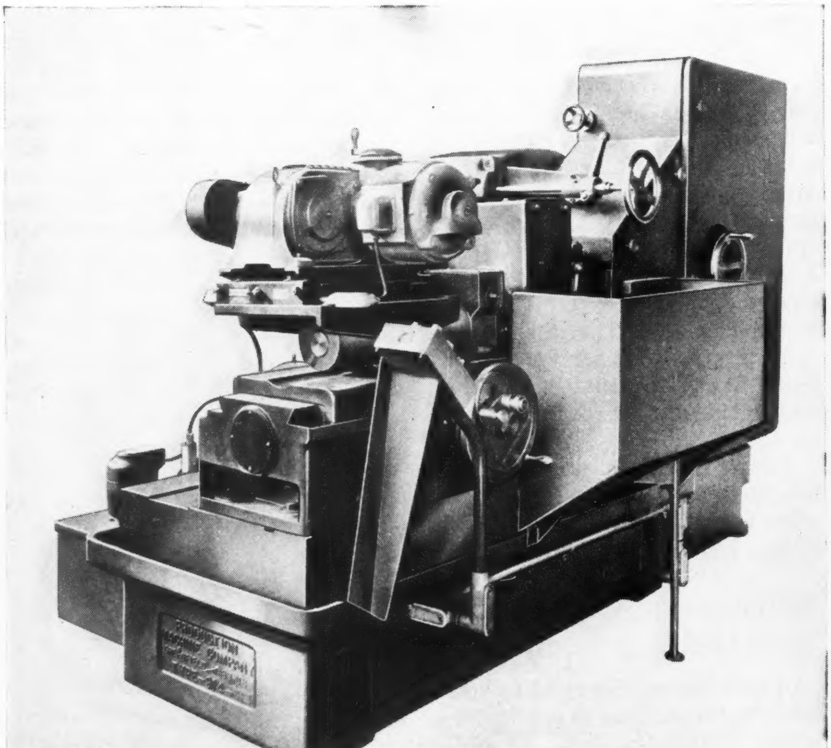
The machine has a capacity of from 1/4 inch to 6 inches, and will handle various types of work by the in-feed or through-feed method. Work guides and supporting fixtures can also be provided for long bar grinding and other applications. 78

Metallizing Guns Designed to Spray at High Speeds

Two new metallizing guns have been announced by the Metallizing Engineering Co., Inc., Long Island City, N. Y. The Metco Type 4E gun, shown in the accompanying illustration, is designed for spraying various types of metals on machine parts, while the Type 5E is intended for applying corrosion protection coatings.

These guns are said to develop the highest spraying speeds yet available in hand-held types. At the same time, they provide the nearest approach to automatic operation yet devised, since they incorporate a patented jet siphon principle in the gas head. This construction automatically compensates for variations in gas pressure as great as 10 pounds per square inch, and is said to provide a steady, unvarying flame which produces uniform coatings at much lower costs.

The new guns also incorporate automatic control of wire feed, which compensates for kinks in the wire, reel-stand drag, etc. The Type 4E gun is designed to spray all sizes of wires from 20 B & S gage to 1/8 inch in any metal, including carbon steel, stainless



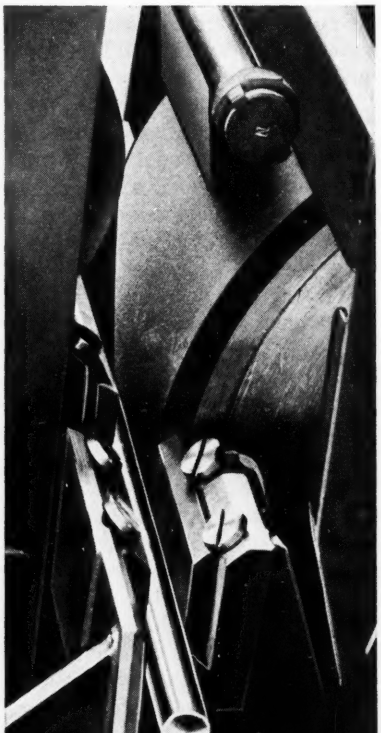


Fig. 1. (Left) Production centerless grinding and finishing machine using abrasive belts and contact wheels. Fig. 2. (Right) Close-up view of work-feeding unit and work-rest of machine shown in Fig. 1

To obtain additional information on equipment described here, use Inquiry Card on page 233.

"Metco" metallizing gun designed for high-speed spraying of metals

steel, Monel metal, bronze, etc., at speeds up to 40 per cent faster than previous models.

The Type 5E is the first gun specifically designed for high-speed spraying of the softer metals, such as zinc and aluminum, to provide corrosion protection to equipment and structures for periods ranging from twenty to thirty years. This gun sprays 3/16-inch wire, and will deposit as much as 55 pounds of zinc per hour and 15 pounds of aluminum. The guns may be mounted on a lathe or other machine in production line work or they can be used in hand-held operation, since they weigh only 4 pounds 12 ounces...79

Movable-Frame Presses Designed to Handle Large Awkward-Shaped Parts

To solve the problem of pressing, bending, and straightening parts that are so large or awkward in shape that they must be moved with overhead materials-handling equipment, the Dake Engine Co., Grand Haven, Mich., has brought out a line of hydraulic presses equipped with movable frames. The new presses are provided with a large area table on which the work can be lowered by a hoist or crane. The press frame is then moved over the table, and the work-head can be moved from side to side along the frame channel. This arrangement facilitates centering the work-head above the work laterally, as well as longitudinally. Provision is made for adjusting work-head up or down.

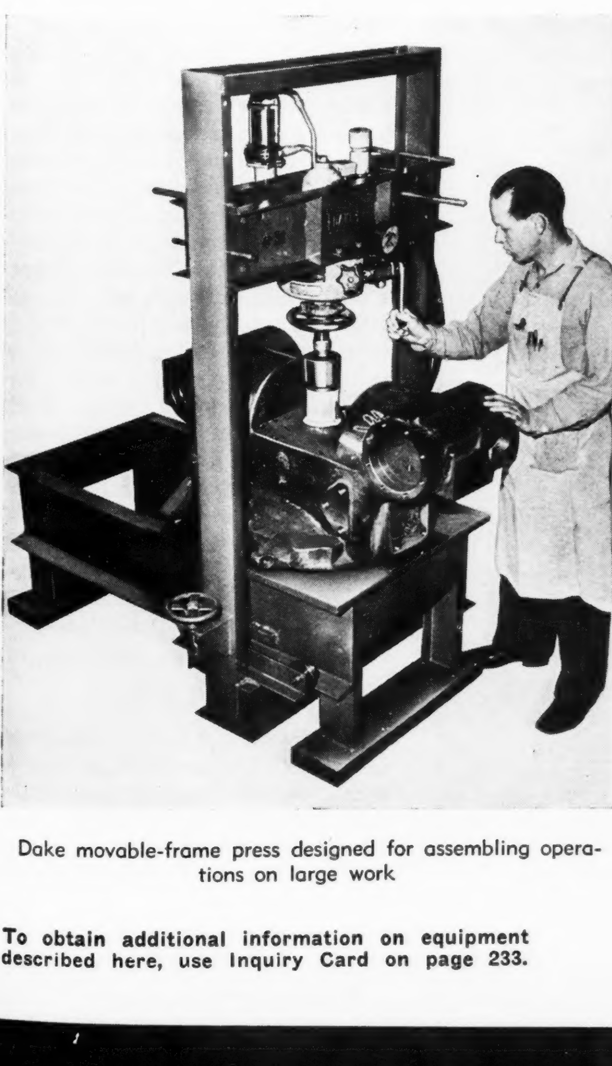
These movable-frame presses are available in capacities of 25, 50, 75, and 125 tons. They can be furnished for either electric or air-powered hydraulic operation. 80

Thunder Bay Presses with Illuminated Beds

A line of presses designed to blank, draw, form, and pierce sheet-metal parts is being manufactured in capacities from 125 to 400 tons by the Thunder Bay Mfg. Corporation, Alpena, Mich. An illuminated bed, designed to eliminate die breakage, is a new feature of these machines. Fluorescent tubes are placed at each end of the bed to provide sufficient light to give the operator a clear view of the dies and bed.

Features of the new presses include bed drilled for die cushion installation; ram length equal to bed length; no interference from gibs; and large gaps in columns to permit feeding of coil stock from the sides of the machine. The presses are available in a wide range of bed sizes, shut heights, and strokes for a variety of uses, ranging from the cutting and perforating of light materials to the blanking, forming, and drawing of heavy sheet metals.

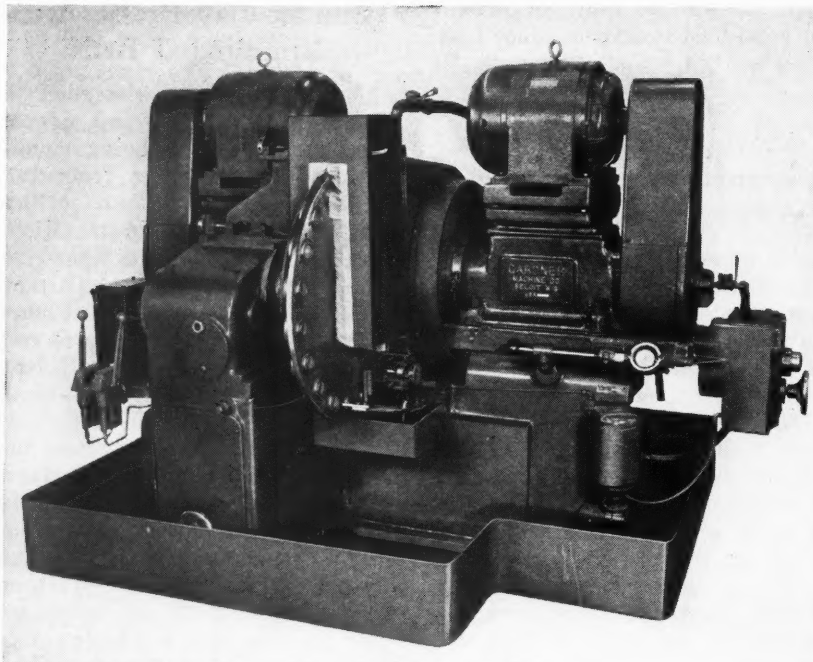
Standard equipment includes a "Tru-Stop" disc brake operated by air cylinders; air mufflers designed to silence clutch and brake operation; and push-button control. 81



Dake movable-frame press designed for assembling operations on large work

Press with illuminated bed introduced by the Thunder Bay Mfg. Corporation

To obtain additional information on equipment described here, use Inquiry Card on page 233.



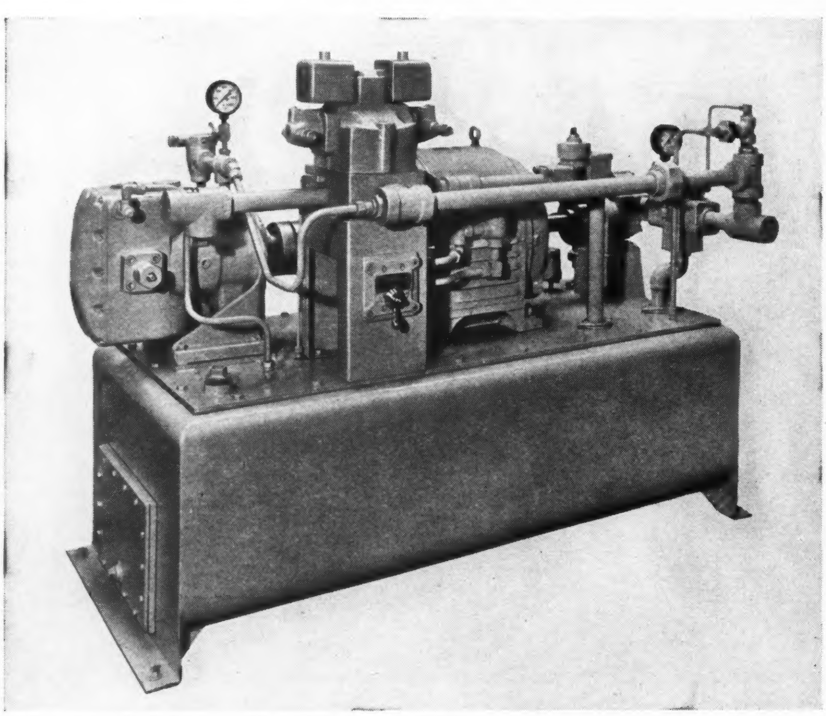
Double-spindle grinder for finishing ends of anti-friction bearing rollers built by the Gardner Machine Co.

Gardner Double-Spindle Grinder for Finishing Bearing Roller Ends

Grinding equipment for rapid, accurate finishing of the ends of anti-friction bearing rollers is a recent development of the Gardner Machine Co., Beloit, Wis. This equipment consists of a 26-inch double-spindle grinder with a heavy cast-iron base which supports the grinding heads on dovetailed slides mounted on ball bearing ways. The heads can be pivoted to the correct angle for best grinding results. The two 4-inch grinding spindles are mounted in special anti-friction bearings, and each of the spindles carries a heavy-duty abrasive disc.

An attachment mounted on the front of the machine drives the rotary work-carrier at a speed that is variable within a ratio of 3 to 1. Interchangeable carriers permit grinding bearing rollers in a wide range of sizes. Two pairs of micrometer-adjusted guides locate the work-piece properly while it is entering and leaving the gap between the abrasive discs. The parts are loaded manually, and are unloaded automatically by a special ejector.

The bearing rollers handled on this machine are 1 3/4 inches in diameter by 1 3/4 inches long. Stock removal averages 0.006 to 0.008 inch per cut. Two cuts are necessary, each being performed at the rate of eighteen pieces per minute. Tolerances are 0.001 inch for parallelism, and 0.002 inch for squareness and uniformity. 82



Rucker oil-hydraulic power and control unit for hydraulic presses

Rucker Oil-Hydraulic Power and Control Unit for Hydraulic Presses

An oil-hydraulic power and control unit designed expressly for converting the older, slow-speed hydraulic presses and extrusion machines to the higher speeds required by modern production is being manufactured by the Rucker Co., Oakland, Calif. These new units have conventional high-low pressure and volume construction, with a compensated high-pressure circuit designed to hold the pressure cycle at the exact speeds desired. This enables the machine operator to obtain the needed cylinder speed quickly, and yet, by manual controls, to alter pressing or extruding during operation as the job progresses.

The unit includes electrically controlled valves, decompression unit, micronic filters, and large oil reservoir tank. Sizes range up to 125 H.P. at a pressure of 5000 pounds per square inch. 83

Condensing Filter for Removing Water from Air Lines

A new filter for compressed-air lines, which functions also as a condenser, has been announced by the Air-Line Engineering Co., Cleveland, Ohio. This device, called the "Airlenco" condensing filter,

To obtain additional information on equipment described here, use Inquiry Card on page 233.

is a new approach to the problem of removing water and oil from air lines. It has a steel outer shell 6 inches in diameter by 36 inches long, and a steel inner cartridge 5 inches in diameter by 24 inches long, which is loosely packed with Fiberglas. A cast-aluminum head with inlet and outlet openings is bolted to a flange welded to the outer shell.

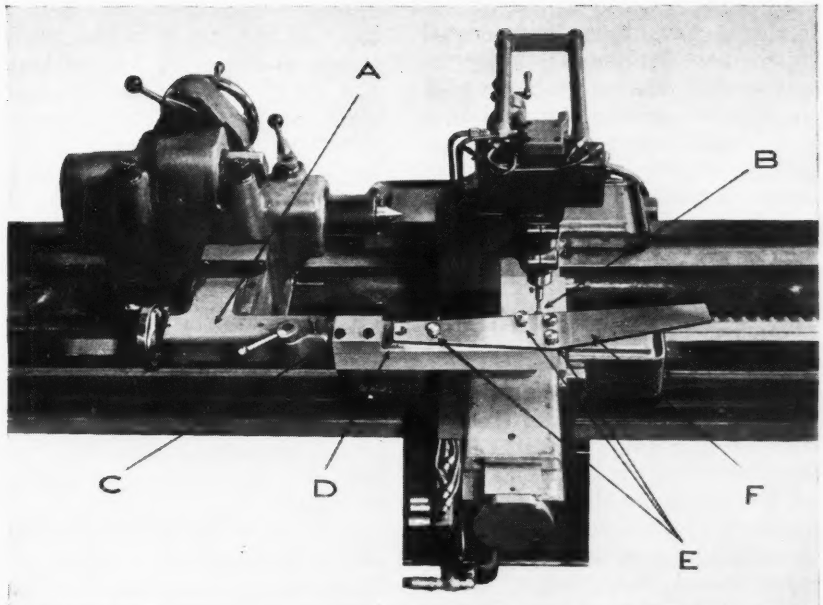
Air enters the inlet opening and passes down between the inner and outer shells. Expansion of the air and the extensive cooling surface that is provided by the design cause any moisture that is in the air to condense and fall to the bottom of the outer shell, where it is discharged through the drain valve. The air then passes through the Fiberglas in the inner cartridge, which baffles out any remaining moisture without appreciably reducing the pressure in the line. Being non-absorbent, the Fiberglas will last for many years, so that the filter requires no servicing, except frequent draining of accumulated water and oil. 84

Horton Large-Diameter Chuck for Right-Angle Lathes

The E. Horton & Son Co., Windsor Locks, Conn., has brought out a new chuck designed especially for use on right-angle lathes. Developed to meet the requirements of the jet-engine manufacturers, this chuck is now being produced in a 36-inch diameter size, which has a holding capacity of from 12 to 36 inches. The new chuck is of the scroll combination type, in which the jaws can be operated independently, universally, or in any combination. It will readily hold distorted pieces which have been stress-relieved in their "as is" position.

The master jaws of the chuck, which are flush with the face, are T-slotted to permit attaching various types of clamping devices. This feature makes it possible to use the chuck as a faceplate if desired. Hard reversible or soft blank top jaws are available.

The chuck body is of semi-steel construction, and is 5 3/8 inches thick. The chuck is available for direct mounting on American Standard spindle noses. All chuck faces have reference lines to aid in setting up. 85



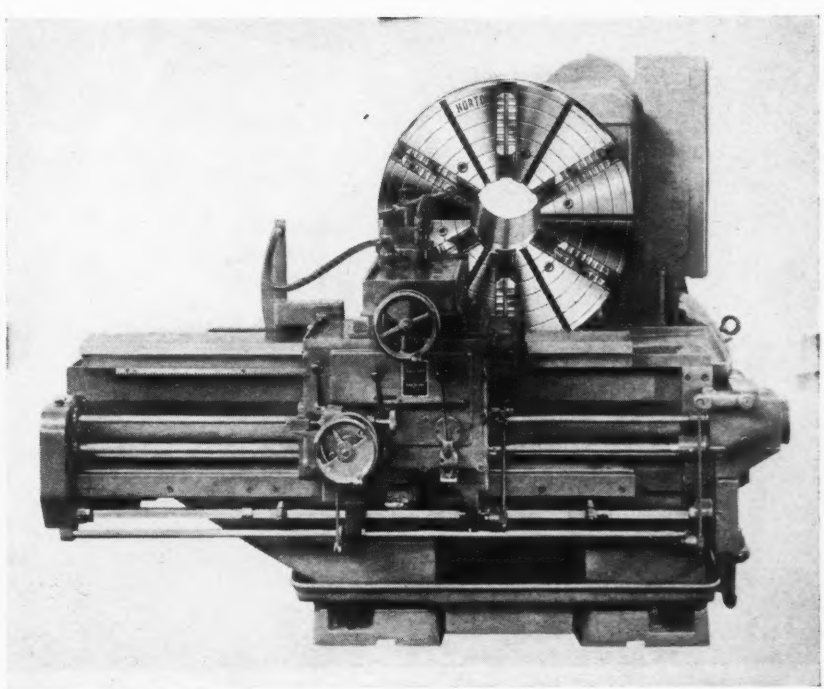
Lodge & Shipley taper-turning attachment with direct-reading scale applied to "Copymatic" lathe

Lodge & Shipley Lathe Attachment Designed for Rapid Taper Turning

A new flat-template taper-turning device has been brought out by the Lodge & Shipley Co., Cincinnati, Ohio, for use on the "Copymatic" lathe. This device is said to make taper turning much easier and faster. The setting for the desired taper can be made on a direct-reading scale, which is part of the attachment. Workpieces with peripheries or bores of continuous tapers can be contour-turned directly with the new attachment.

When tapers form but a part of the surface, the attachment is used to produce a round template, which is then placed between the standard "Copymatic" duplicating centers for tracer-controlled duplication in any desired quantity.

A swivel-bar *F* and a taper



Horton large-diameter chuck mounted on Lodge & Shipley T-Lathe

To obtain additional information on equipment described here, use Inquiry Card on page 233.

scale *D* have been incorporated in the new flat-template taper arrangement. The swivel-bar, which is mounted on the standard tail-end template support, can be accurately adjusted to the desired taper. It takes but a minute to unlock the bar, set it to the proper taper, as indicated by the scale, and relock it. The tail-end template support of the standard "Copymatic" is shown at *A*, swivel-bar lock-screws at *E*, stylus at *B*, and spindle at *C*. 86

Snyder Special Machine for Processing Intake Manifold

A twenty-two-station, in-line, transfer type machine has been designed by the Snyder Tool & Engineering Co., Detroit, Mich., for processing the intake manifold of V-type engine blocks. The machine drills, taps, reams, and spot-faces all holes and mills the carburetor and water outlet pad at an output rate of seventy-two pieces an hour.

With this machine loading is accomplished manually, while controls are automatic in normal use, but can be switched over for manual operation if desired.

The work-piece is hydraulically located and clamped at each station, and is moved between stations by a hydraulically operated transfer bar. High-speed steel tools and carbide milling cutters are used, and they are preset and changed manually. Speeds of 80 surface feet per minute are employed in drilling, and 250 surface feet per minute in milling operations.

Fixtures move on V-type rails having hardened and ground surfaces to minimize wear. Standard guide-bar and way type units have been adapted for use on this machine. The operation requires no special skill, and the operator is protected by guards and by the use of effective interlocking electrical switches.

The machine is furnished with automatic lubrication. The base and column of the machine are constructed of welded steel. A floor space of 10 by 40 feet is required. 87

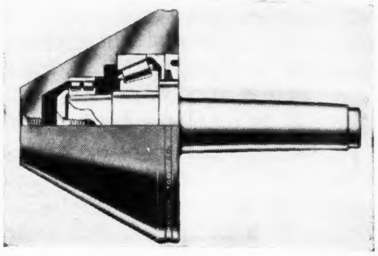
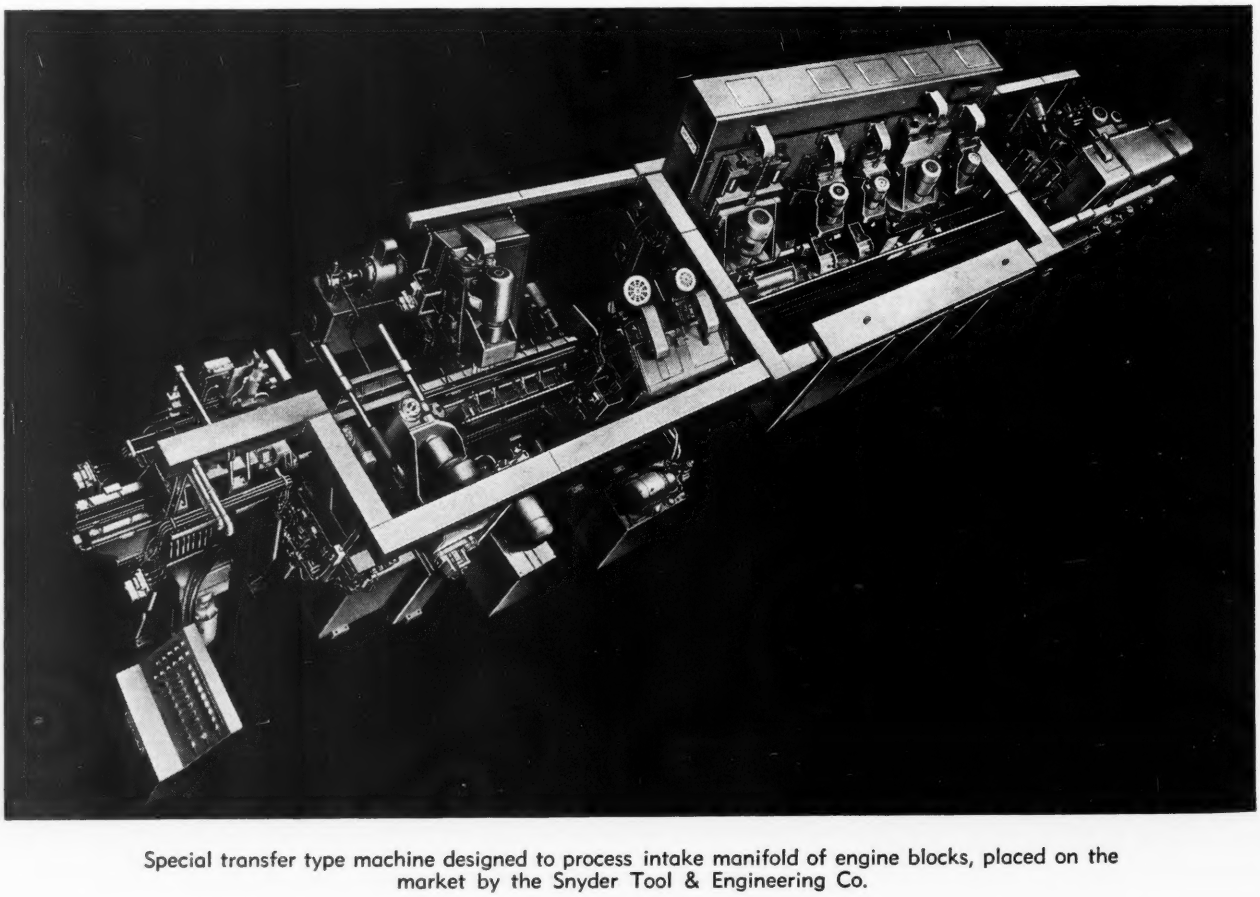


Fig. 1. "Red-E" extra heavy duty shank type bull-nose center

"Red-E" Anti-Friction Bearing Lathe Centers

The shank type, bull-nose "Red-E" center shown in Fig. 1 has been designed expressly for extra heavy duty work by the Ready Tool Co., Bridgeport, Conn. Two single-row precision, anti-friction bearings, shrunk on (not pressed on), spaced well apart, and preloaded for maximum radial and thrust capacities, support loads up to 10 tons.

The center head is of hardened tool steel, and is available in sizes up to 24 inches. The shank is of heat-treated alloy steel, made with Morse, Jarno, Brown & Sharpe, Hendey, or special tapers,



Special transfer type machine designed to process intake manifold of engine blocks, placed on the market by the Snyder Tool & Engineering Co.

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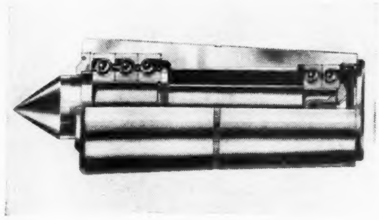


Fig. 2. "Red-E" center designed to minimize overhang and permit interchange with dead center

and in straight styles. The bearings have sealed-in lubrication.

An anti-friction center of built-in type (Fig. 2) is another new development of the Ready Tool Co. This center is designed to eliminate overhang and permit full clearance, as well as maximum distance between centers. It is assembled with precision angular-contact ball bearings, pre-loaded and "locked in," and is mounted for maximum radial and thrust load capacity. Labyrinth seals retain the bearing lubricant and shut out dust, chips, and coolant. This center can be installed to permit quick interchanging with a dead center. 88

DoAll New Mobile Inspection Unit

The DoAll Co., Des Plaines, Ill., has announced a compact inspection cabinet for use with the mobile inspection system introduced by the company several years ago. The new unit is smaller, lighter, and easier to handle. It is designed to do inspection work right on the job, and is equipped with all the instruments necessary for complete inspection of working gages.

Under the mobile inspection system, a complete set of gages and fixtures is maintained at each machine. These gages are used to pass or reject the work produced on the machine. Each gage or fixture is marked with an identifying color that determines the regularity with which it is checked by the roving inspector.

The new mobile inspection unit is 37 inches high, 28 inches wide, and 18 inches deep. There is a ledge around the top which prevents tools and gages from sliding off to the floor. An adjustable light illuminates the table. 89

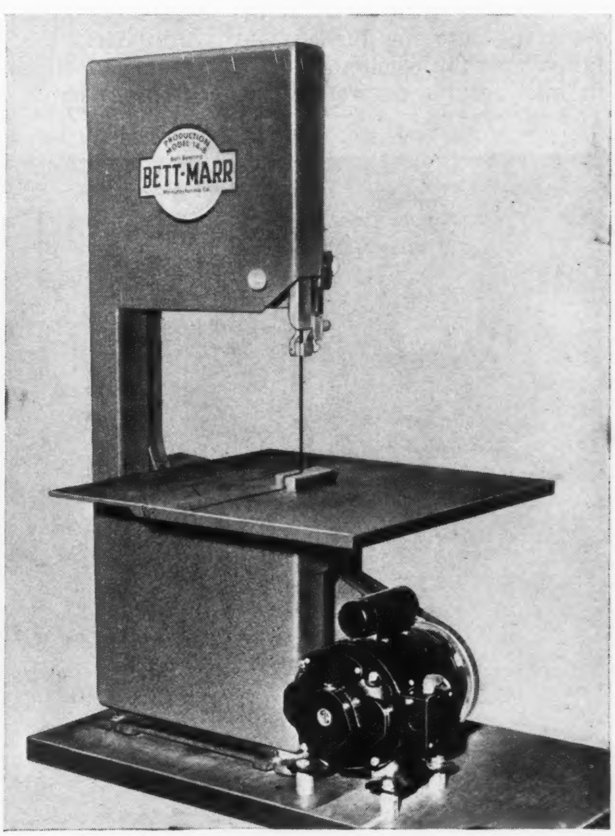
Bett-Marr Band Saw

The Bett-Marr Mfg. Co., Hopkins, Minn., has announced a new band saw designed for production work in metal, plastic, sheet metal, and woodworking shops. A powerful chain drive, designed to eliminate blade chatter and allow full power transmission at slow speeds, is said to give cleaner, faster cutting of such materials as iron and steel castings and forgings. The speed range is from 125 to 2200 feet per minute.

Blades up to and including 1/2 inch in width can be used. The capacity for taking an 8 3/4-inch deep cut permits the saw to be used to advantage in finishing castings. Cuts can be taken on stacked galvanized sheet-metal pieces (fifty or more) at speeds up to 15 inches per minute.

Intricate cutting jobs encountered in fitting ducts can be performed on this saw in a fraction of the time necessary for hand cutting. The 20- by 22-inch table permits handling large work. The machine has an over-all height of 34 inches. It is equipped with a set of four sheet-metal clamps and riser-bar for sheet-metal work...90

Mobile inspection broqght out by the DoAll Co.



Mobile inspection unit brought out by the by the Bett-Marr Mfg. Co.

To obtain additional information on equipment described here, use Inquiry Card on page 233.

Dow Pitless Controlled-Atmosphere Furnace

The Dow Furnace Co., Detroit, Mich., has announced the development of a small, pitless, batch type controlled-atmosphere furnace for production gas cyaniding, gas carburizing, bright hardening, and carbon restoration. This Model G self-contained furnace is completely mechanized and designed for easy operation. It is especially suited for small commercial heat-treaters and manufacturing firms.

In operation, it will heat 500 pounds of work from room temperature to 1500 degrees F., in one hour, provided the furnace is stabilized at control temperature when the load is introduced. Loads up to a maximum of 600 pounds of work can be processed, although the loads will naturally vary with the type of parts, temperatures, and case depths.

Uniform, rapid heating is accomplished by four radiant tubes fired by standard Dow burners. A gas generator system of catalytic type is incorporated within the radiant tubes to supply a gas neutral to medium carbon steels. An unusual feature of the tube and generator system is that the generator gas can be analyzed before going into the furnace. A high volume fan combined with a fan inlet assures a directed flow of atmosphere through the furnace load. Quenching is done directly from furnace vestibule.....91

Automatic Double Roll-Feed Multi-Stage Press

A heavy-duty 50-ton multi-stage roll-feed press manufactured in England is now available in the United States through the British Industries Corporation, New York City. This press is a completely new design with variable-speed motor, centralized control panel, improved roll feed, adjustable air counterbalancing, magnetic clutch and brake unit, and all-steel cabinet.

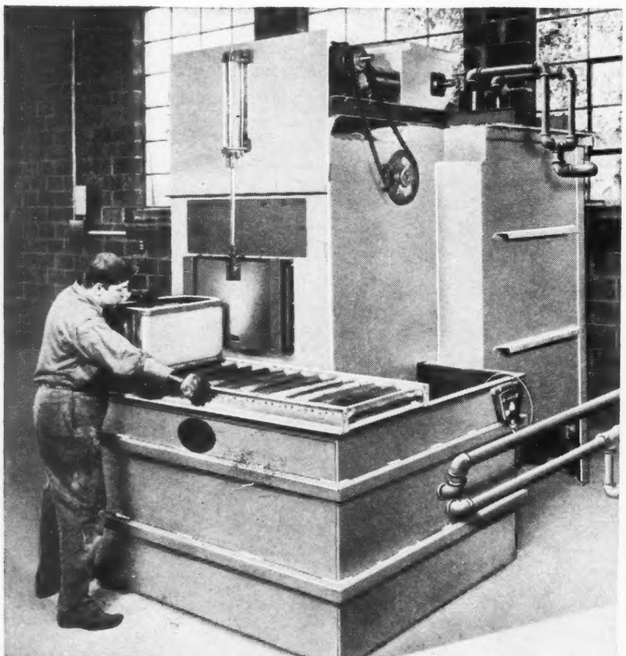
The speed of the press is infinitely variable, and permits any multi-stage tool to be operated at the most efficient speed, with the additional advantage of extended die life. The feed can be easily and accurately set. Automatic double roll feeds are provided, each being independently adjustable to maintain progression accuracy. Production of about 18,000 parts an hour is obtained.

A scrap cutter attachment which is synchronized with the roller feed and can be adjusted to cut the scrap at the weakest point is available. The press is controlled from an inclined panel at the front of the machine. 92

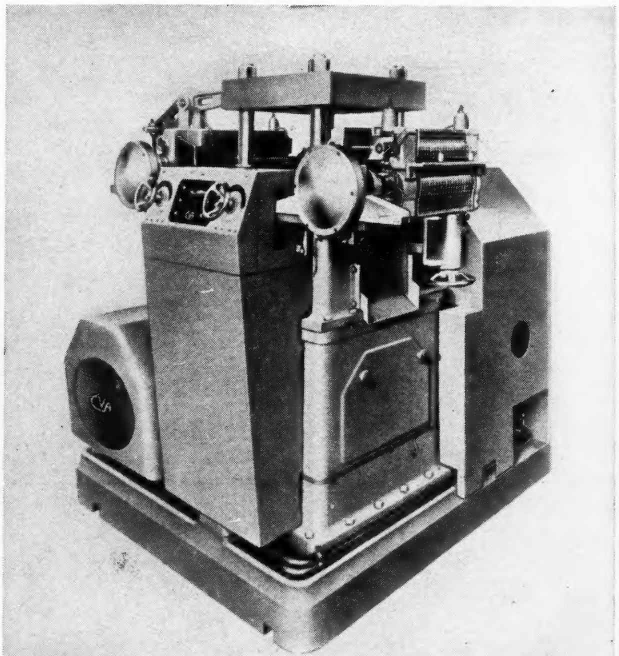
Swiss carbide tool grinding and lapping machine introduced by the Carl Hirschmann Co.

Carbide Tool Grinding and Lapping Machine

The Carl Hirschmann Co., Manhassett, N. Y., United States representative for Safag, S.A., Bienne, Switzerland, is introducing in this country a Safag precision machine for grinding and lapping carbide tools. The new



Small, pitless, self-contained controlled-atmosphere furnace placed on the market by the Dow Furnace Co.



Multi-stage press with double roll feed, introduced in this country by British Industries Corporation

To obtain additional information on equipment described here, use Inquiry Card on page 233.

machine, identified as the Safag No. 27 hard metal tool grinding and lapping machine, is applicable for all hard metal tools used in Swiss type screw machines. Special equipment is available for grinding drills, turning tools, etc.

The machine takes grinding wheels 5.9 inches in diameter, and will grind tools having shanks of any size up to 0.8 by 1 inch. The weight of the machine, including stand and motor, is 400 pounds...93

Hampton Speed Chuck with Individual Jaw Adjustment

A speed chuck with wide capacity range which will handle all shapes of stock with the same jaws has been placed on the market by the Wallace Pawley Enterprises, Los Angeles, Calif. This new product, known as the Standard Hampton speed chuck, has three jaws which close universally; yet each jaw is capable of individual adjustment over its full capacity range. This permits exact "zeroing" adjustments, eccentric chucking, and accurate centering of square stock with three jaws.

Only three sets of jaws are required to cover the full capacity range from 1/8 to 1 inch. A second model covers the range of from 1/8 inch to 1 5/16 inches with four sets of jaws.

Round work can be gripped or released in a lathe without stopping the spindle. Adapters are furnished for all small lathes and most medium-size lathes, including cam lock and taper spindles. These chucks can also be used on milling machines and drill presses or wherever repetitive chucking is required. Special tongued adapter plates are available for stationary applications. 94

Columbia Improved Power Press Brake Line

Expansion of its power press brake line to include a complete range of sizes, with capacities from 120 to 1000 tons, for forming mild steel from 3/16 to 1 inch thick, 6 to 20 feet long, has been announced by the Columbia Machinery & Engineering Corporation, Hamilton, Ohio.

Notable among the improvements incorporated in the new machines is a device developed to release the ram should the dies strike bottom. This device consists of a heavy steel wedge, with the top angle complementing a similar size angle on the base of the ram adjustment socket. Held securely in position by two cap-screws, it can be released by unscrewing the cap-screws and moved back to provide a 1/4-inch additional downward travel of the ram.

Models of 350 tons capacity and larger can be furnished with a two-speed transmission affording a speed ratio of approximately 4 to 1. Special throat depth, stroke, and shut height can also be furnished, and all models can be equipped with air counterbalances and air-operated solenoid-actuated clutches. 95

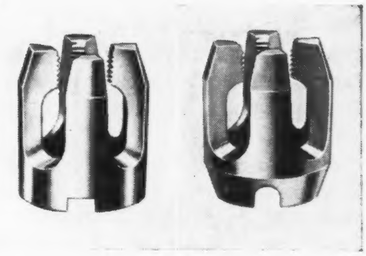


Fig. 1. (Left) P & W "Monocone" die. (Right) P & W "Duocone" die

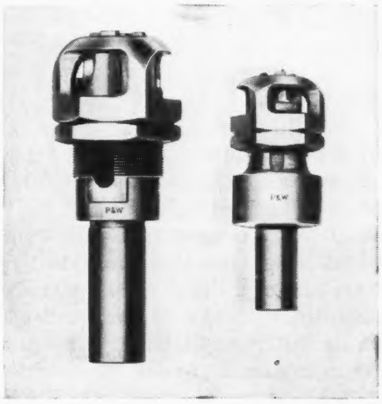
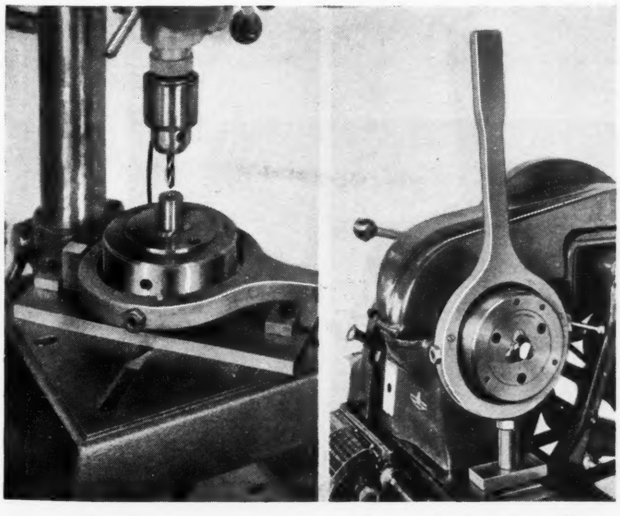


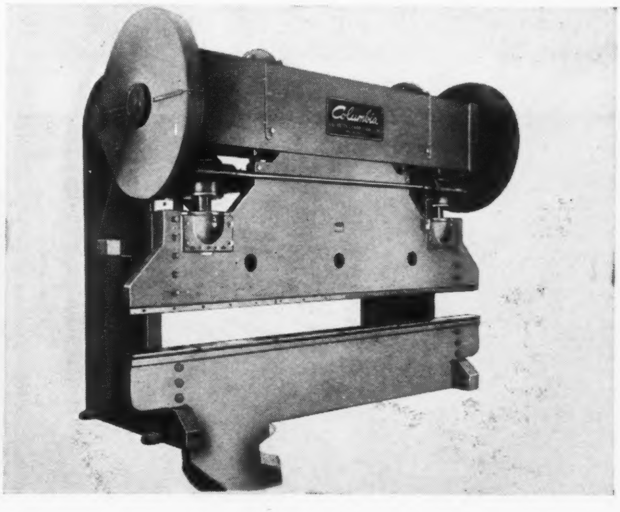
Fig. 2. P & W holders with dies shown in Fig. 1

P & W Dies and Holders for Screw Machines

"Monocone" dies and die-holders for screw machines and other equipment are now being produced by Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford, Conn., as companion products to their "Duocone" line of dies and holders. Introduction of the "Monocone" tools provides users with a choice of two types of P & W concentric adjustment



Speed chuck with wide capacity range placed on the market by Wallace Pawley Enterprises



Power press brake of improved line announced by the Columbia Machinery & Engineering Corporation

To obtain additional information on equipment described here, use Inquiry Card on page 233.

dies—flat-back and cone-back. The dies may be obtained in screw gage sizes from 0 through 14 and in fractional sizes from 1/16 inch through 1 1/8 inches.

As seen at the left in Fig. 1, the "Monocone" die is conical at the nose end only. It is driven by lugs, and is centralized in the holder by tightening the adjusting cap. The "Duocone" die, shown at the right, Fig. 1, is tapered at both ends, and is aligned by the adjusting cap and a conical seat in the holder. This die is driven by a dowel which engages notches in one end.

Both dies are otherwise similar in construction. They are made of either high-speed or carbon steel as required, and are heat-treated to obtain the best combination of hardness and toughness for long life. A test piece is supplied with each die as evidence of its cutting qualities. The dies are produced under conditions which insure a thread that will be free from distortion and taper when the die is closed down to size. Both of these dies are adjusted by compression radially toward the axis, thus insuring concentricity.

Holders for these dies, shown in Fig. 2, are produced in both reversing and releasing types. The reversing holders are designed for use on automatic screw machines and other machines which have positive reversal with minimum lag. The releasing holders are made for such applications as hand screw machines, where the reversing operation is dependent upon the operator. If the spindle is not reversed in time by the worker, the die-head disengages and spins with the work, so that it does not damage shoulders or collets. When the spindle is reversed, the die automatically drops back into the locked position and unscrews from the work.....96

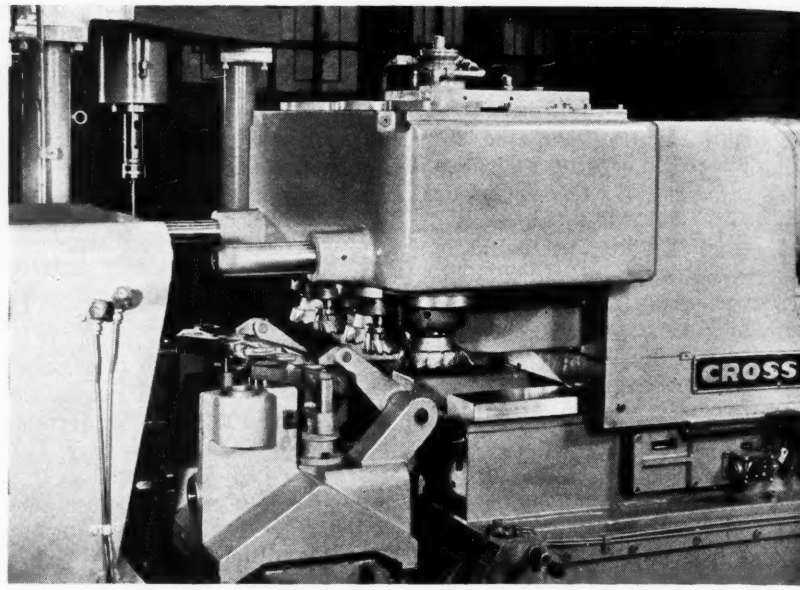


Fig. 1. Multiple-spindle milling head with "Cross-Drive" pre-set cutters arranged for milling five manifold pads

Cross Cutter Driving Device and Gage for Accurate Pre-Setting of Cutters

A cutter driving device that makes possible the pre-setting of many types of tools is a recent development of The Cross Company, Detroit, Mich. The new arrangement, known as the "Cross-Drive," features quick changing, pre-set cutters, and a spindle drive that holds the cutter securely.

With this drive, shown in the cut-away view, Fig. 2, cutters can be changed in less than a minute. The worn cutter is removed by simply loosening a large lock-nut and sliding the cutter out of the spindle. A new pre-set cutter is then inserted.

Lost time is eliminated with pre-set cutters because the adjustments can be made while the machine is running. There is no need for trial cuts, since the cutter length is pre-set to a dial indicator reading to 0.0005 inch. A master length gage is supplied with the fixture shown in Fig. 3 to establish the limits on the indicator.

The long, straight shank of the "Cross-Drive" is gripped securely by a four-point collet, assuring a true running tool. A large square at the end of the shank makes the drive positive. The thrust is taken against the bottom of the hole in

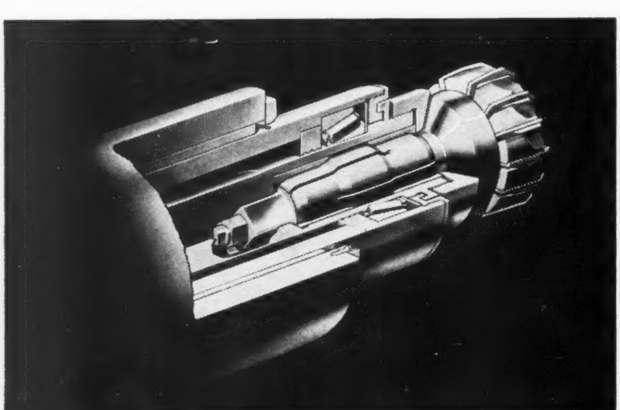


Fig. 2. Cut-away view of new "Cross-Drive"

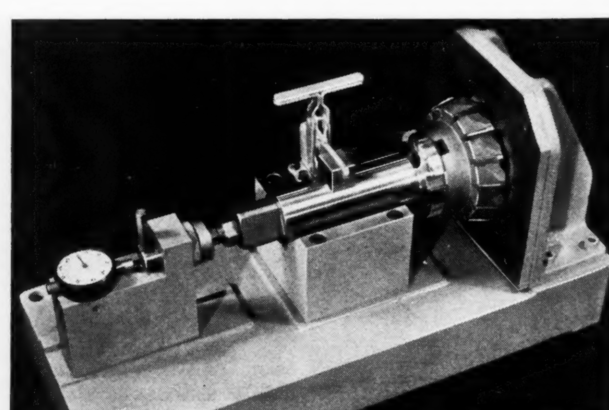


Fig. 3. Fixture for setting cutter shown in Fig. 2

To obtain additional information on equipment described here, use Inquiry Card on page 233.

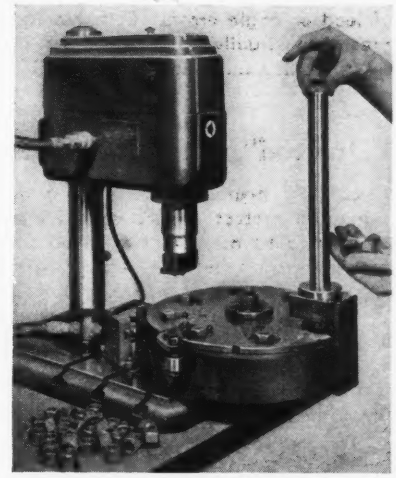
the spindle by an adjusting screw. This new drive is adaptable to a variety of cutters. Shank sizes are standardized in diameters of 1 1/2, 2, and 2 1/2 inches.........97

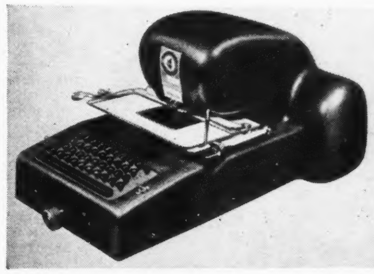
Cadillac Time-Saving Marking Machines

The Cadillac Stamp Co., Detroit, Mich., is manufacturing an air-operated automatic marking machine, shown in Fig. 1, which is especially adapted for light, flat marking. This machine, which is known as the "Automark," has been tooled to mark as many as 15,000 parts per hour. The dial feed fixture adaptation illustrated is for marking brass nuts at the rate of 3000 per hour. This machine can also be readily adapted for high-speed color marking by the branding method. It operates from an ordinary 110-volt light socket, and produces up to 9000 pounds impact pressure when operated from a 100 pounds per square inch air line.

Fig. 1. (Right) "Automark" automatic marking machine manufactured by the Cadillac Stamp Co.

Fig. 2. (Below) Cadillac electrically operated metal-marking typewriter

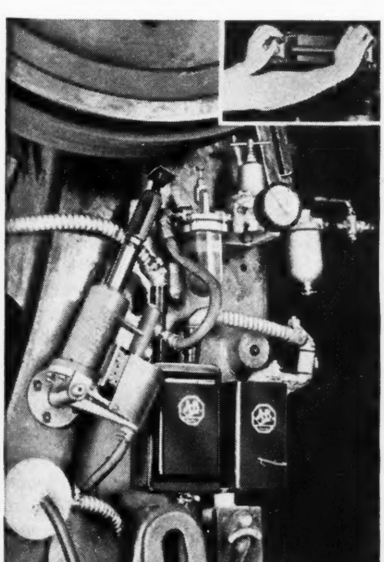




The "Automark" electrical metal-marking typewriter shown in Fig. 2 is designed for rapid detailed marking of nameplates. This all-electric machine does not require a skilled operator. Interchangeable letter wheels are made from high-grade alloy tool steel in different type sizes. The machine produces clear-cut letters on nameplates, and through easy adjustment marks clearly on steel (before hardening) up to 1/2 inch thick. 98

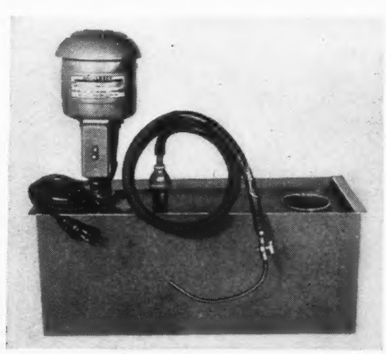
Electric-Pneumatic Control for Punch Press Clutch

Clutch control for press which permits the foot-treadle to be replaced by a set of two electric starting buttons. This control requires the use of both hands, one on each button, as shown by insert in upper right-hand corner of illustration. The electric-pneumatic control thus keeps both of the operator's hands out of the danger zone as the press ram descends, and leaves them free to pick up the next piece of work. It is designed to allow the ram to descend only once each time the two start buttons are pushed. Made by Tech-n-Kal Machine & Engineering, Detroit, Mich. ..99



Shellback Portable Coolant Unit

Portable coolant unit with capacity for pumping 30 gallons of coolant per minute up to a height of 12 feet. Designed to furnish an ample supply of coolant for an eight- or ten-spindle drill press. It can be used on a single-spindle drill press, lathe, broaching machine, cutting-off machine, or cutter grinder. Arrangements can be made to feed three or four different machines at the same time if desired. A neoprene bearing, which is unaffected by the coolant, practically eliminates wear on the bearing shaft. The 1/4-H.P. pump motor operates on 110-volt, 60-cycle current. The container holds 11 gallons, is 10 by 10 by 26 inches in size, and is furnished with chip screen and sediment baffle. The 3/8-inch neoprene hose is 6 feet long and is equipped with shut-off and flexible nozzle. Made by the Shellback Mfg. Co., Hazel Park, Mich. 100



Hanson-Whitney Thread Comparator

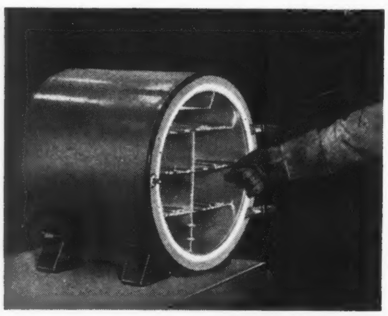
Dual thread comparator developed by the Hanson-Whitney Co., Hartford, Conn., as a companion to its standard thread comparator. This instrument is designed to provide a more thorough visual inspection of externally threaded parts up to 1 1/2 inches in diameter. In addition to the jaw that checks the thread for assembly by means of one composite reading of pitch diameter, lead, and angle, there is a second jaw with a two-thread engagement, which provides a specific check of pitch diameter, as well as a check of back taper on very short threads. The sec-

To obtain additional information on equipment described here, use Inquiry Card on page 233.

ond check also indicates the presence of lead or angle errors. Both readings are taken visually on a single dial indicator. 101

"DryRod" Electrode Oven

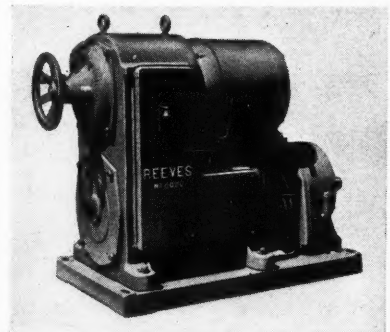
Electrically heated portable oven designed to protect mineral-coated electrodes against moisture absorption during the period between unpacking of the manufacturer's sealed containers and use of the electrodes in the welding line. This "DryRod" electrode oven is heated by an 840-watt element operating on 110- or 220-volt circuits. Variable thermostat gives close control



of temperatures up to 600 degrees F. The oven will hold 350 pounds of 18-inch electrodes. Manufactured by Philip Roden Co., Milwaukee, Wis. 102

Reeves "Vari-Speed Motodrive"

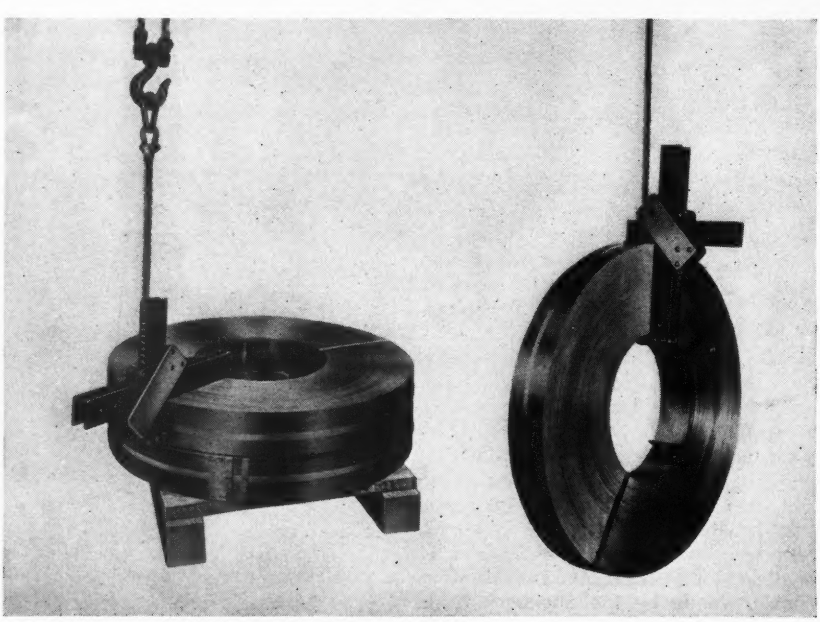
New size "Vari-Speed Motodrive" announced by Reeves Pulley Co., Columbus, Ind. The new unit, designated Model No. 8000, has a capacity of 25 H.P., and is available in all speed range

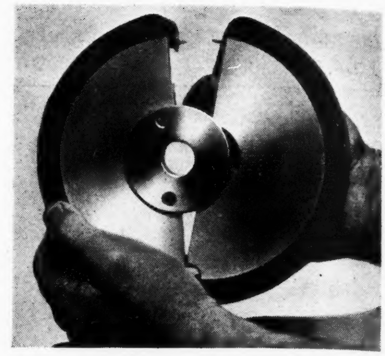


ratios from 2 to 1 to 6 to 1. This self-contained variable-speed drive combines in a single unit the Reeves speed-varying mechanism, any standard constant-speed motor, and a built-in helical gear reducer when low output speeds are required. Made in horizontal and vertical designs. Handwheel control is standard, but electrical or completely automatic hydraulic controls are available if desired. A tachometer may also be attached to this drive if required. 103

Device that Facilitates Lifting Coiled Stock

Coil grab designed to enable a single crane operator to lift a coil of strip stock from a pallet and place it in a vertical position in one easy motion. The grab has a tapered prong which is inserted between the stacked coils, while a jaw opposite the prong is placed in the center of the coil, as shown at the left. As the coil is lifted, the grab turns, allowing the coil to assume a vertical position, as shown at the right. The grab is designed to handle coils weighing up to 2000 pounds. Placed on the market by Materials Handling Division of Dixon Research, Inc., Rockford, Ill. 104





"Cone-Loc" Drum Sanders

Improved, cushion type split drum, designed to make possible the use of coated abrasives in low-cost strip form. The two halves of this "Cone-Loc" drum sander are clamped together by a locking cone when the arbor nut is tightened. A new backing flange has been incorporated recently as an integral part of the sanding tool to insure a safe, strong, and balanced abrasive drum. "Cone-Loc" drum sanders are manufactured by American Diamond Saw Sales, Portland, Ore., and sold exclusively by the Carborundum Co. and the distributors of Carborundum coated abrasives. 105

Labelon Tape for Marking Parts

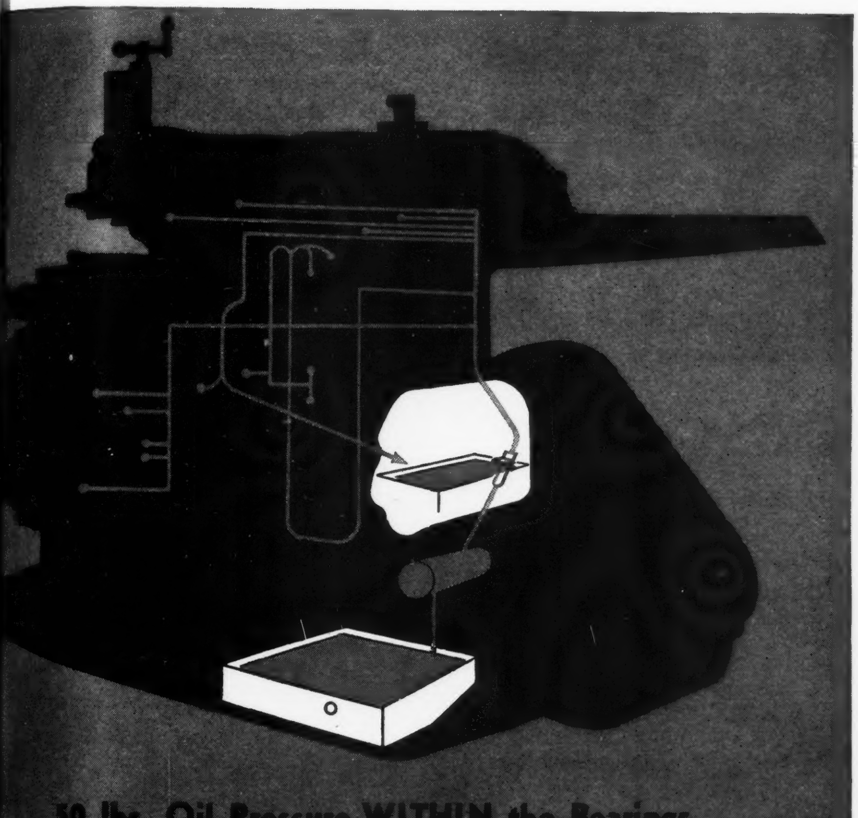
Pressure-sensitive tape on which identification numbers, sizes, and notes can be easily written. Available in four colors and five widths from the Labelon Tape Co., Rochester, N. Y. Pressure of a pencil or other writing instrument on a waxy layer makes the impression on the tape. Labels can be typed on a typewriter with the ribbon lever set to "Stencil." Since no ribbon is used, there is no ink to smudge. The pressure-sensitive adhesive, which requires no moistening, will adhere to metal, wood, glass, or almost any clean surface, and can be transferred from one surface to another. 106

To obtain additional information on equipment described here, use Inquiry Card on page 233.

-another Cincinnati Exclusive Feature!

50 lbs. Oil Pressure

maintained in running bearing surfaces



50 lbs. Oil Pressure WITHIN the Bearings

For the first time in the shaper field, bearings on a shaper operate under a positive 50 lbs. oil pressure within the bearings.

Even the most inaccessible bearings of the Cincinnati rocker arm and crank block assemblies operate under a positive pressure oil supply. For the first time, inefficient lubrication by dripping or spraying oil on these bearing surfaces is replaced by full pressure lubrication.

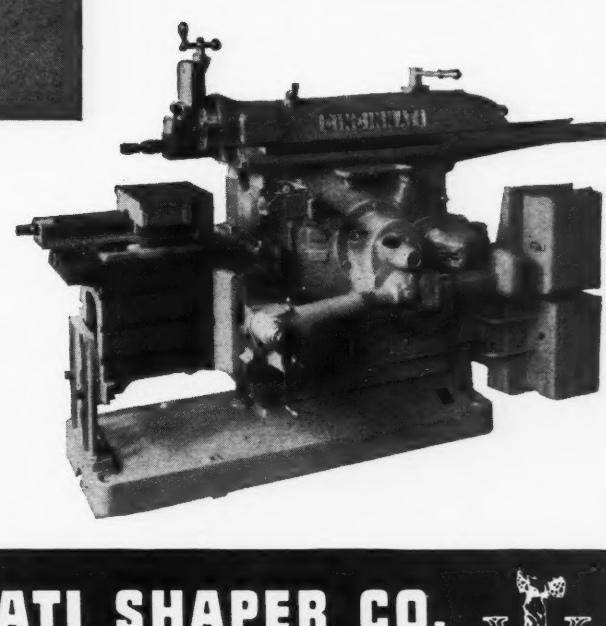
Wear and friction are reduced to a minimum giving Cincinnati Shapers extra years of maintained accuracy and maximum power at the cutting tool.

The system is fully automatic, saves the operator time and is insurance against oiling failures.

Write for Catalog N-5, fully describing these versatile, powerful and productive Cincinnati Shapers.

Other exclusive features . . .

1. Cincinnati Electro-Magnetic Clutch
2. Cincinnati Multiple-Cam Feeds
3. Cincinnati Single Adjustment Tapered Gibs.
4. Cincinnati Extended Solid Ram Bearings
5. Cincinnati Dovetail Crank Block and One-piece Crank Gear.
6. Cincinnati Protected Table Support.



THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

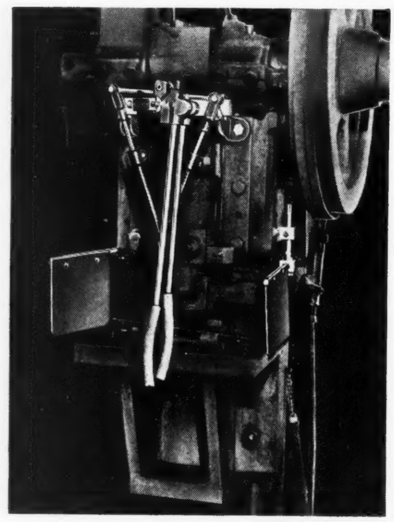
CINCINNATI

Keller Pneumatic Thread-Gaging Tool

Air-driven tool designed to speed inspection of threads in tapped holes, using standard taper-lock plug gages. Operation is extremely simple. Just pressing inward causes the motor to spin, screwing a "Go" gage into the hole; pulling outward causes it to reverse the back out. The gaging tool has a powerful air motor, with friction clutch and gage adapter, and weighs only 34 ounces. Regularly furnished with an adapter to accommodate gages with thread diameters from 0.510 to 0.825 inch. Product of Keller Tool Co., Grand Haven, Mich. 107

Searjeant Power Press Guard

Double-arm sweep type guard especially adapted for use on short-stroke, long-die power presses. When the ram is in the "up" position, both guard arms are suspended in front of the center of the bolster plate, and do not interfere with two-handed operation. As the ram descends, the arms swing, one right and one left, from their central position. The entire working area of the press is thus swept clear before the down-



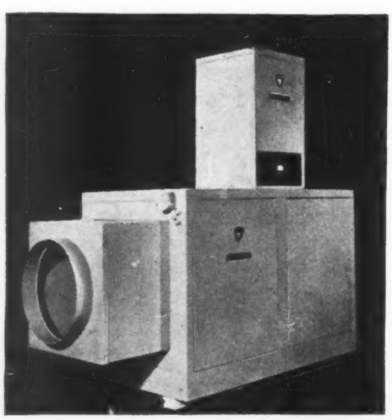
ward stroke has progressed far enough to close on the fingers or hands of the operator. Brought out by Searjeant Metal Products Co., Mendon, N. Y. 109

Nilco Pistol Type Bore Gage

Pistol type bore gage designed for checking work on machines where limited space makes it impractical to use a standard length bore gage. Features include provision for positioning indicators so that they face the operator at all times, and for adjusting the handle to the proper checking depth. This gage has three-point alignment, a two-point gaging feature, and one-piece construction centralizing plungers. Any size, type, or make of indicator can be used on the gage. Five models covering a range of bore sizes from 1 inch to 12 inches are available. The gage can be made longer or shorter than standard to suit the user's specifications for gaging depth. Made by the Nilsson Gage Co., Inc., Poughkeepsie, N. Y. 110

"Vim" Rubber-Impregnated Leather Packing

New type of rubber-impregnated leather packing made by E. F. Houghton & Co., Philadelphia, Pa. Combines the lower friction and greater strength of leather with the perfect sealing, resilience, and heat resistance of rubber. Advantages include ease of assembling; exceptional resistance to oils and solvents, resistance to heat as high as 200 degrees F.; resistance to plastic flow or extrusion; low friction characteristics; high abrasion resistance; and reinforced fiber structure, which results in a longer useful life. 111



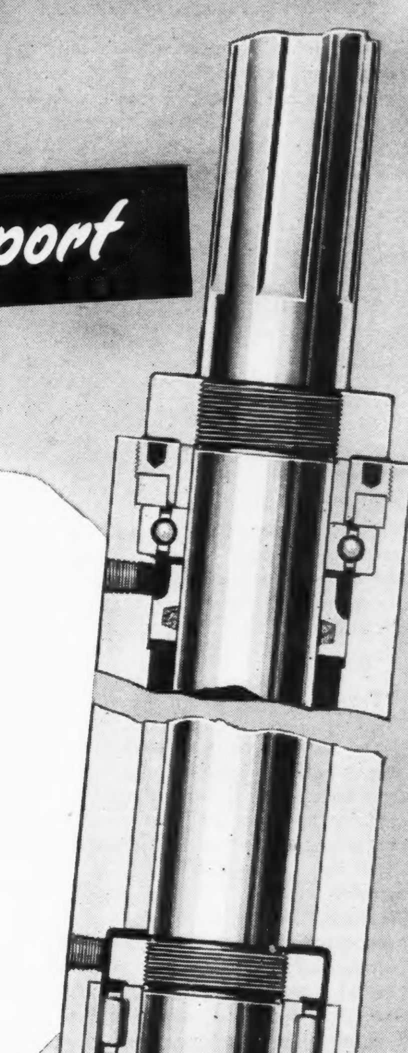
Trion Oil-Mist Precipitator

Oil-mist precipitator developed by Trion, Inc., McKees Rocks, Pa., to eliminate hazardous conditions caused by fine oil-mist emanating from high-speed cutting and grinding machines. With this equipment, the oil mist from machining operations is charged as it passes through an electrostatic field. The electrostatically charged mist is then attracted to plates of opposite polarity, from which it drains into a pan for re-use. The use of the precipitator eliminates fire hazards created by oil deposits and prevents harmful effects on the machine operators. ..108

To obtain additional information on equipment described here, use Inquiry Card on page 233.

Unusual Tool Capacity

Unusual Spindle Support



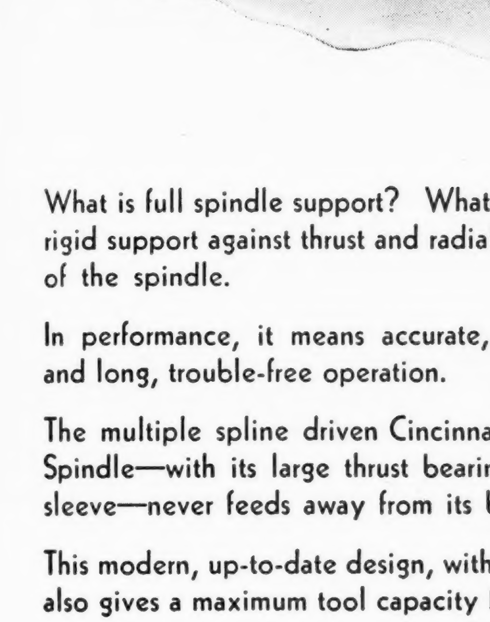
What is full spindle support? What does it accomplish? It's rigid support against thrust and radial load—at ALL positions of the spindle.

In performance, it means accurate, smooth power delivery and long, trouble-free operation.

The multiple spline driven Cincinnati Bickford Super Service Spindle—with its large thrust bearing and its special sliding sleeve—never feeds away from its bearings.

This modern, up-to-date design, with 36 speeds and 18 feeds, also gives a maximum tool capacity for any given size.

Write for Circular R-29 for details of construction of this Cincinnati Bickford Super Service Radial Drill.



This machine is furnished in sizes 11" to 19" diameter column, 3' to 8' arm.

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO.

RADIAL AND UPRIGHT SUPER CB SERVICE DRILLING MACHINES

Radials 7½" dia. col., 2½' arm, to 26" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
Jig Borers, Portable Horizontals, Spacing Table Machines.

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

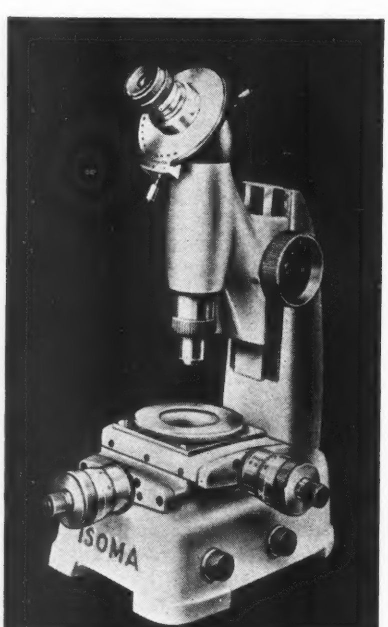
Commander Coolant Table for Precision Drilling

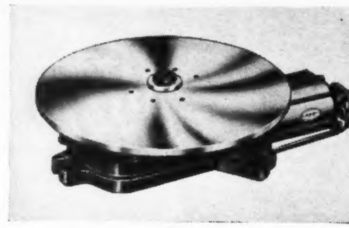
Coolant table equipped with a built-in pump and reservoir and eight semi-rigid, flexible metal coolant nozzles, recently introduced by the Commander

Mfg. Co., Chicago, Ill. This table, with its self-contained coolant circulating system, will deliver an adequate supply of coolant from any of the eight adjustable nozzles. 112

Toolmaker's Microscope

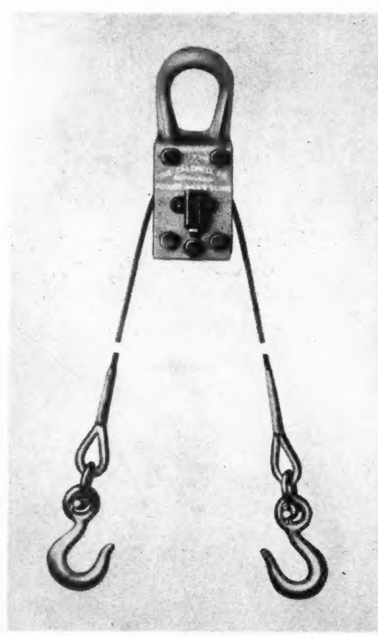
Isoma toolmaker's microscope designed especially for measuring watch and instrument parts, extremely small screw machine parts, and similar items. This microscope has interchangeable objectives for 20X, 30X, 50X, or 100X magnification; a 360-degree angle measuring device, fully graduated and numbered to 10 minutes; adjustable illumination for both top and underneath lighting of work-piece; and many work supporting and holding accessories. The micrometer spindles are calibrated in 0.005 and 0.00005 inch. Two models are available, with object tables 3 1/4 inches square and 3 7/16 by 3 3/8 inches. Introduced in United States by Cosa Corporation, New York City. ..113





Bellows Heavy-Duty Dial Feed

Electrically controlled, air-powered rotary work-feeder with a 22-inch diameter table top, announced by the Bellows Co., Akron, Ohio. This dial-feed table can be set to index to four, six, nine, twelve, eighteen, or thirty-six stations. Loads up to 1000 pounds can be accommodated. The table is powered by a special 3 5/8-inch bore Bellows air motor, with built-in "Electroaire" directional valve and speed controls. The table top can be removed for mounting jigs and fixtures. 114

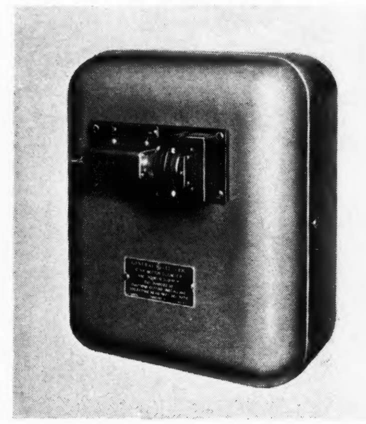


Self-Adjusting Sling for Lifting Crane

"Adjust-A-Leg" equalizing sling designed to facilitate the proper balancing of machines or loads for lifting by overhead cranes. The equalizing unit is placed on the crane hook and centered over the load, after which the sling legs are hooked to the load. As the crane lifts, the legs, turning on a sheave, adjust themselves to the proper lengths. The weight of the load locks the legs in place, and the load is carried in a level position. Two-thirds of the rated load can be imposed on one leg without slippage. Made in eight sizes with capacities from 3/4 ton up to 15 tons. Manufactured by the Caldwell Co., Rockford, Ill. 115

G-E Step-Motor Impulse Counter

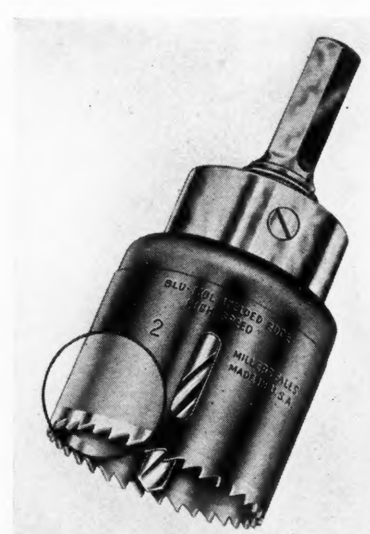
Step-motor impulse counter designed to provide one hundred per cent accuracy up to sixty counts per second. Built to cover counting ranges above those pos-



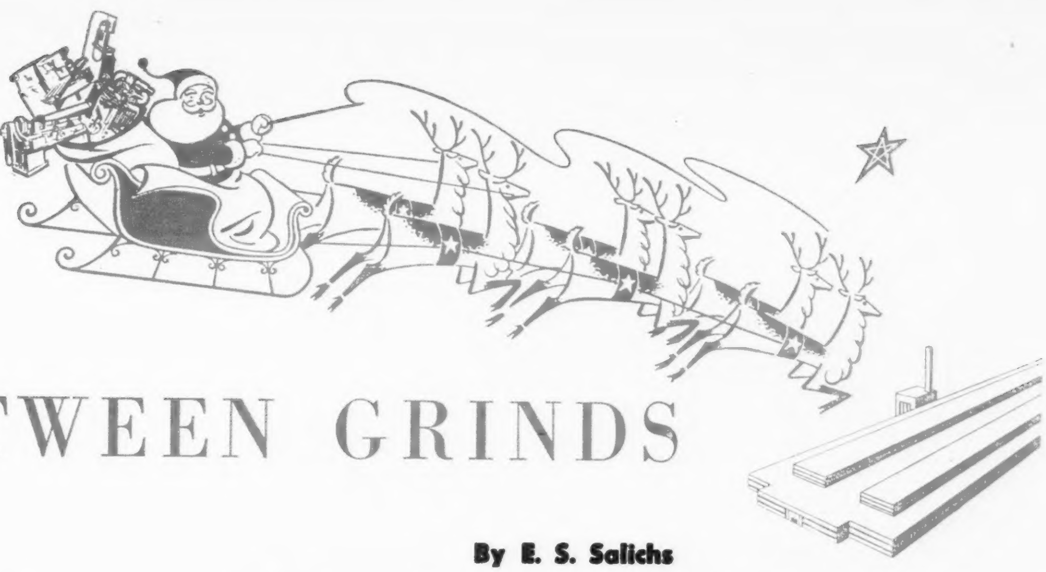
sible with electro-mechanical counters and below those in which scalers are normally required. Announced by the Special Products Division of the General Electric Co., Schenectady, N. Y. 116

"Blu-Mol" Hole Saws

High-speed, heavy-duty follow-through type "Blu-Mol" hole saw made in forty sizes ranging from 5/8 inch up to 4 1/2 inches in diameter by the Millers Falls Co., Greenfield, Mass. These saws have a specially selected high-speed steel edge welded to an extremely tough alloy-steel back. They are practically unbreakable, and are capable of fast, clean cutting in any machinable material, such as hard and mild steels, aluminum, brass, and bronze, iron and steel pipes, plastics, etc. Holes to a depth of 1 1/8 inches can be cut in solid stock. This tool can be used equally well in radial drilling machines, lathes, and drill presses. 117



To obtain additional information on equipment described here, use Inquiry Card on page 233.



BETWEEN GRINDS

By E. S. Salichs

Seasonal Shopping

From MACHINERY'S Yuletide stockroom, we selected for our readers the makings of a jolly Christmas—the fun of being surrounded by family and friends, holiday cheer without headaches, good foods that won't fatten, and a heavy sock of you know what—all packaged with a tag marked Rush—Merry Christmas, Happy New Year!

Sir!

In the excitement of ordering a book from us, one correspondent began his letter a bit unconventionally, "Dear can you furnish me with your latest edition of MACHINERY'S HANDBOOK?"

Epistles to Engineers

Maintenance Division of the U. S. Corps of Engineers sends out a monthly "Maintenance Letter" to engineer regional maintenance representatives, and we noted Letters 50 and 51 contained generous abstracts of articles published currently in MACHINERY, one on drilling aluminum alloys and the other on brazing and bronze welding.

Mica in Miniature

Two Westinghouse men built a scale model of the four-story mica plant at Irwin, Pa., in which they work. The miniature plant was made in the garage of one of the men, and 1300 man-hours (a year's spare time) and 4500 pieces of wood were involved in the project. Now the model may be used in planning the lay-out of equipment, making materials-handling studies, and analyzing the flow of mica products through the plant. We have an idea their wives had a house-to-garage communication system installed to issue edicts on lunch-time, the midnight oil, and guests at the front door.

Running Comment

In the process of digging up some old correspondence in the files, we came across a letter from a contributor concerning an article of his to be published: "I note that your sketch represents a four-lip end-mill, although the material refers entirely to two-lip mills. Do you think that this point should be corrected?" Below it, an unsigned pencil notation, staff-written, read: "It shoor shood."

The Four Max Brothers

How a company formulated its corporate name is told by the Formax Mfg. Co. in its letter-head: Stick figures of four brothers by the surname of McAleer.

Handiwork

An instructor at Arizona State Prison wanted to know names of companies that manufacture eyelet making machines. For a moment we thought the boys were taking to embroidery, maybe punching Madeira-like holes in the outer walls; then we decided the eyelets were probably for shoes.

Any Minimum Age Requirement?

A new club has come into existence, the Young President's Organization; eligibility hinges on a person being less than thirty-nine years old and being president of a company that sells more than a million dollars of merchandise annually.

Sticking His Scalp Out

On a visit to a large plant, one of our editors was amused by a sign on someone's desk: "Too Many Chiefs, Not Enough Indians."

Guests by Tests?

A communication reached us written on the letter-head of the Crazy Hotel, in Mineral Wells, Tex. From its picture, seemed to be a large place too.

Uproaded

Stedfast & Roulston, Inc., in the same location for fifty-three years, had to make way for a speed highway being built in Boston. Stedfast took it hard, but Roulston (shortened from Rolling Stone) looked forward to the change.

The winners of the Ingenious Mechanisms Contest will be announced in January MACHINERY!

News OF THE INDUSTRY

California

Arthur E. Johnson has been transferred by the Carboloy Department of the General Electric Co. to the Pacific district office, which is located at 5905 Pacific Blvd., Huntington Park, Calif. Prior to this, Mr. Johnson was assistant to the director of the Customer Training School that the Carboloy Department maintains in Detroit, Mich.

Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa., has opened a sub-office in Los Angeles, Calif., to assist the San Francisco district office in better serving the West Coast area. H. A. Nielsen is in charge of the new office, which is located in the Pacific Electric Bldg., 610 S. Main St., Los Angeles 14.

Reed-Prentice Corporation, Worcester, Mass., has appointed the Western Molders Supply Co., Los Angeles, Calif., representative in California, Arizona, and New Mexico for the Reed-Prentice line of plastic injection molding machines and die-casting machines.

L. L. Meikle has been elected president of the Lincoln Engineering Co. of California, to supervise the entire West Coast Division for the Lincoln Engineering Co., St. Louis, Mo., manufacturer of equipment for the application of lubricants.

Rotex Punch Co., Oakland, Calif., manufacturer of turret punch presses, has opened a second plant in Oakland, located at 5215 E. 12th St., thus adding 7000 square feet to the company's facilities.

James A. Miller has been appointed manager of the newly opened sales and engineering office in Los Angeles, Calif., of the Reeves Pulley Co. Harlan M. Gillis will be Mr. Miller's assistant.

Illinois and Kansas

A. J. McAllister has been appointed president and general manager of the Detroit Gear Division of the Borg-Warner Corporation, Chicago, Ill. Prior to his appointment, Mr. McAllister was president and general manager of the Fairfield Mfg. Co., Lafayette, Ind. He succeeds Howard D. Blood, who, while continuing as vice-president and director of the parent corporation, is assuming charge of the new Products Development Laboratory in Detroit. D. T. Sicklesteel, previously vice-president in charge of engineering for the Detroit Gear Division, becomes general manager of the new laboratory.

J. W. Oliver has been appointed district manager by Charles H. Besly & Co., Chicago, Ill., of a territory including eastern Michigan, Indiana, western Ohio, and Kentucky. Mr. Oliver was formerly sales and service representative for the company's Cutting Tool Division.

Gilbert H. Gidley has been appointed abrasive engineer in Chicago for the Norton Co., Worcester, Mass., while Gordon F. Colson, who was temporarily located in Worcester, will resume his full-time activities as field engineer in the Chicago area.

Tuthill Spring Co., Chicago, Ill., manufacturer of leaf springs, has opened a new plant in Momence, Ill., for the manufacture of agricultural implement parts.

A. J. Wilhelm has been elected vice-president in charge of manufacturing for the Clearing Machine Corporation, Chicago, Ill., builder of presses. Other appointments include Ray Prochnow as general superintendent of factory operations, and Fred Pottberg as master mechanic.

A. J. Wilhelm, vice-president in charge of manufacturing for the Clearing Machine Corporation

Emerson Electric Mfg. Co., St. Louis, Mo., has moved its Chicago district office to larger quarters at 1623-25 S. Pulaski Road, Chicago 23, Ill.

Master Mfg. Co., Hutchinson, Kan., has appointed the following representatives for the distribution of Master lathe converters: George E. Zweifel & Co., 103 S. W. Front Ave., Portland, Ore.; and George E. Viereck Co., 1507 M St., N. W., Washington 5, D. C.

Indiana

Studebaker Corporation, South Bend, Ind., has announced the appointment of P. O. Peterson and K. B. Elliott as executive vice-presidents. Prior to the new appointments, Mr. Peterson served as vice-president in charge of manufacturing, and Mr. Elliott as vice-president in charge of sales. Newly elected vice-presidents are E. C. Mendler, who was previously general manager of the parts and accessories division, and R. A. Hutchinson, formerly general manager of the export division.

W. Burl Saul has been named vice-president in charge of production and engineering of the L & J Press Corporation, Elkhart, Ind. Mr. Saul was formerly a partner in the Power Press & Equipment Co., Toledo, Ohio, and is a member of the standards committee of the punch press group of the National Machine Tool Builders' Association.

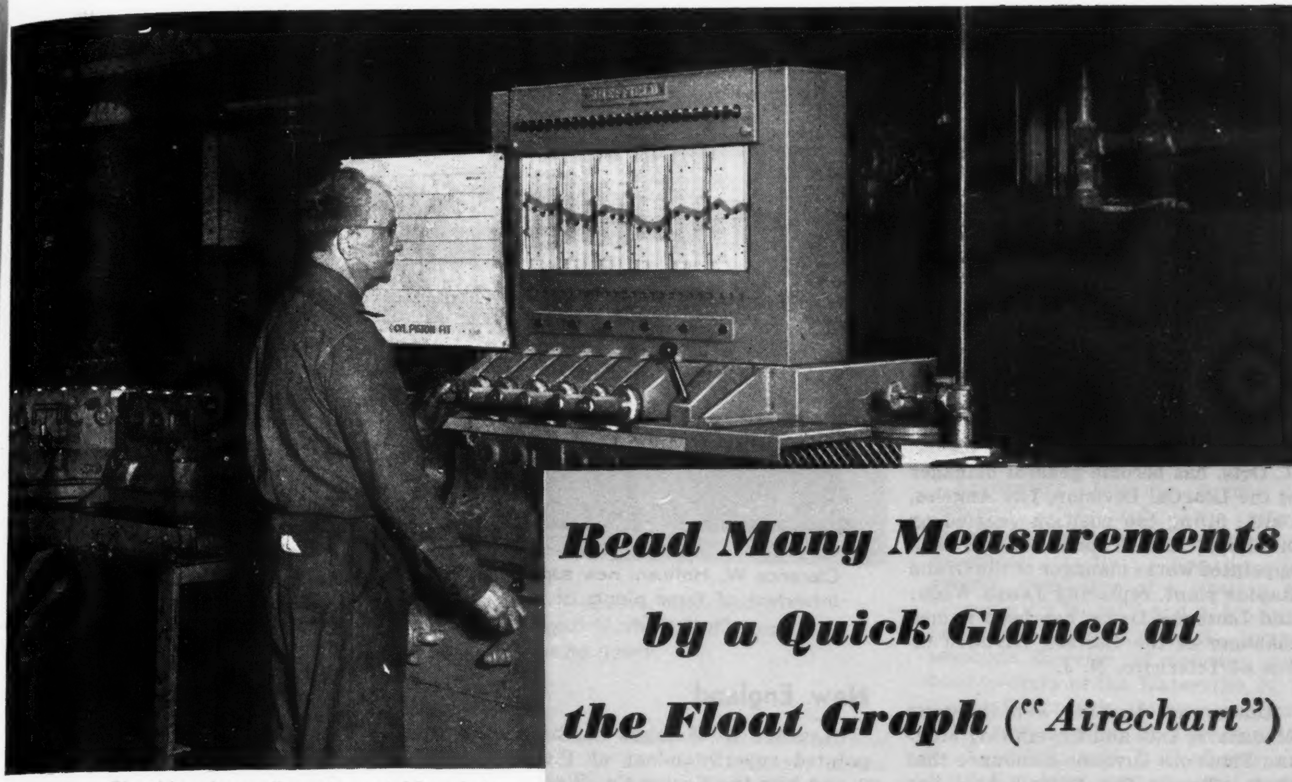
Bert L. Pearce has been appointed chief engineer of the Ewart plant in Indianapolis, Ind., by the Link-Belt Co., Chicago, Ill. He succeeds Charles R. Weiss, who has retired after forty-two years' service with the company. Russell T. Sweeney has been made assistant chief engineer.

John A. Rozos was recently appointed director of exports for the Dodge Mfg. Corporation, Mishawaka, Ind.

Louisiana

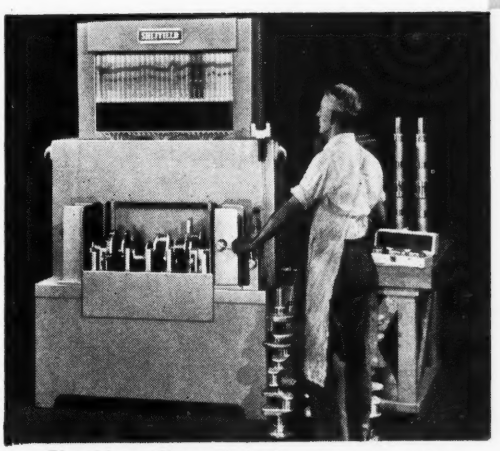
Oliver H. Van Horn Co., Inc., 1742 St. Charles Ave., New Orleans 1, La., has been appointed representative in Louisiana and Mississippi for the Colonial Broach Co., Detroit, Mich.

Julius H. Nill has been appointed southern regional manager by the

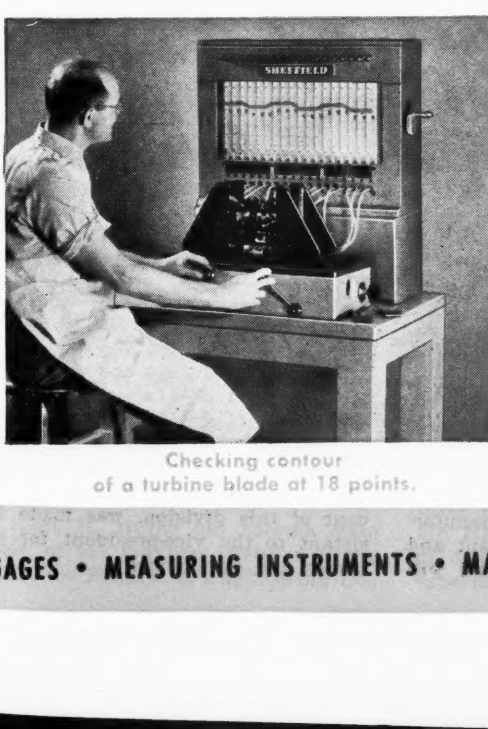


Read Many Measurements by a Quick Glance at the Float Graph ("Airechart")

Checking bore diameters at 18 points.



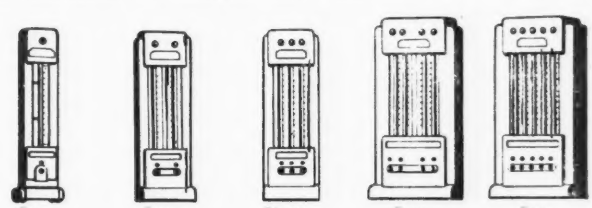
Checking 27 crankshaft measurements.



Checking contour of a turbine blade at 18 points.

Each individual measurement is indicated by the position of a float in its respective Precisionaire column.

The float positions form a characteristic pattern similar to a graph. It's actually a quality control chart. The inspector sees at one quick glance whether the work part can be passed or should be rejected, and for what dimensions. No eye strain, no close concentration, no figures to remember, no confusion of multiple dial faces with the "Airechart."



One Column · Two Column · Three Column · Four Column · Five Column

Standard Precisionaire column instruments are made with one, two, three, four or five columns. Special Precisionaires can be built to include from 6 to 30 or more columns depending on the number of dimensions to be checked.

For complete details on simultaneous multiple measurements with the Precisionaire, call your local Sheffield representative, send prints to us or write for Bulletin CTP-491.

the Sheffield corporation
DAYTON 1, OHIO, U. S. A.

GAGES • MEASURING INSTRUMENTS • MACHINE TOOLS • CONTRACT SERVICES • THREADING TOOLS

Metallizing Engineering Co., Long Island City, N. Y., with offices in New Orleans, La.

Michigan

LEAR, INC., Grand Rapids, Mich., manufacturer of rotary gear and rotary vane pumps and valves, announces the following changes in personnel: A. G. HANDSCHUMACHER has been made general manager of the Michigan Division; W. DAWKINS ESPY, vice-president, has been appointed chief engineer for the Grand Rapids Division, succeeding C. E. WILLIS, who recently resigned; GEORGE K. OTIS, has become general manager of the LearCal Division, Los Angeles, Calif., filling the position vacated by Mr. Espy; A. H. ENDLEKOFER has been appointed works manager of the Grand Rapids plant, replacing JAMES WOOD; and LEMOYNE DABBS has been named manager of the Eastern Division office at Teterboro, N. J.

CINCINNATI MILLING AND GRINDING MACHINES, INC. and CINCINNATI MILLING PRODUCTS DIVISION announce that their office in the Detroit area has been moved to new quarters at 24100 N. Woodward Ave., Pleasant Ridge, Mich., which double their facilities for selling and servicing machine tools, grinding wheels, and Cimcool cutting fluid.

FLOYD E. MENGEL has been appointed general manager in charge of sales and manufacturing for the Morton Machine Works, Detroit, Mich. ERIC BUTTERWORTH has joined the company in the capacity of manufacturing superintendent.

S. C. LLOYD has been appointed sales manager of the Pre-Engineered Division of Mechanical Handling Systems, Inc., Detroit, Mich. He was formerly connected with the Rapids Standard Co., Grand Rapids, Mich.

LANDIS TOOL CO., Waynesboro, Pa., announces that its Detroit branch office has been moved from the New Center Building to 17151 Wyoming Ave., Detroit 21, Mich.

Mississippi and Georgia

ROCKWELL MFG. CO., Pittsburgh, Pa., manufacturer of Delta power tools and industrial equipment, recently opened a branch plant comprising 160,000 square feet, at Tupelo, Miss. The Rockwell plant is the first large machine tool operation of its kind in the state of Mississippi.

L. G. BARTON has retired as manager of the Atlanta, Ga., branch of the Wagner Electric Corporation's Electrical Division. W. H. PREWITT, JR., has been appointed to fill the vacancy.

Clarence W. Halleen, new superintendent of three plants of the Norton Co.

New England

CLARENCE W. HALLEEN has been appointed superintendent of Plants 1, 2, and 3 by the Norton Co., Worcester, Mass., replacing IRVING B. LOUD, who is retiring after thirty-five years of service with the company. JOHN MATSON has been made assistant superintendent of these plants. LORENZO S. WASHBURN has been appointed quality manager of the Abrasive Division, succeeding CHARLES J. HUDSON, who is retiring. Mr. Hudson has been with the company thirty-four years.

STERLING SALES, INC., 787 Main St., Worcester 3, Mass., has been appointed representative for the SIZE CONTROL CO., Chicago, Ill.

THOMAS F. GRIFFIN has been appointed purchasing agent for the Holyoke, Mass., Works of the Worthington Pump & Machinery Corporation.

FRANK J. MILLER, general sales manager of the New Departure Division of General Motors Corporation, Bristol, Conn., for the last three years, retired recently after thirty-three years of service with the Division. CHARLES D. MCCALL, formerly manager of the regional sales office in Detroit, Mich., succeeds Mr. Miller. LORNE F. LAVERY, who was assistant general sales manager, has been transferred to Detroit to fill the vacancy created by Mr. McCall's promotion, while HOWARD A. OFFERS, previously manager of the Midwest regional office at Chicago, Ill., has become assistant general sales manager.

ALAN R. BURMAN has been appointed vice-president of the Cro-Plate Co., Hartford, Conn., manufacturer of wet-blasting equipment and hard chrome-plating units, and will take over the management of all sales activities for the company. Mr. Burman was also appointed a member of the board of directors, replacing the late T. L. BRANTLY, JR.

HAROLD W. BEDER, JR., was recently appointed general sales manager of the Whitney Chain Co., Hartford, Conn.

ANTHONY F. WARD has been appointed representative in the New England area for the line of automatic drilling and tapping machinery made by the HARTFORD SPECIAL MACHINERY CO., Hartford, Conn. Mr. Ward's office will be at 242 Taunton Ave., East Providence, R. I.

New Jersey and Delaware

TOPPER EQUIPMENT CO., Matawan, N. J., manufacturer of metal cleaning equipment, has purchased the OPTIMUS EQUIPMENT CO., a subsidiary of the Hanson-Van Winkle-Munning Co., that manufactured industrial vapor degreasers and Circo automotive degreasers. The Topper organization will occupy the plant of the Optimus Equipment Co. at Matawan and will retain most of the personnel.

L. J. SMITH was recently appointed to the newly created position of eastern regional sales manager for the Chiksan Co., Brea, Calif., manufacturer of swivel joints and coupling unions. His headquarters will be at the company's Newark, N. J., office.

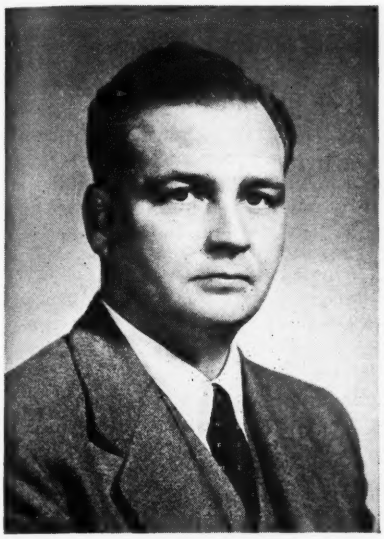
WALTER J. BISSINGER has been named research and development engineer by Gould & Eberhardt, Inc., Irvington, N. J., replacing CHARLES A. POEKEL, who recently resigned. Mr. Bissinger has been associated with the company for twelve years.

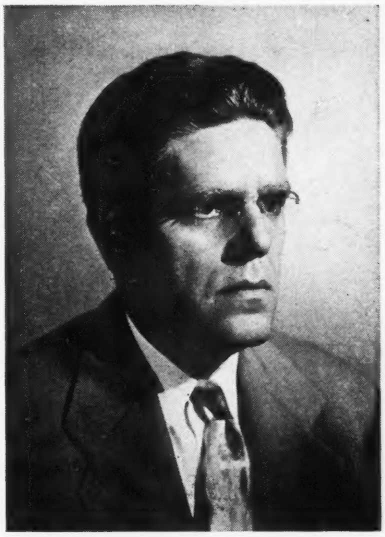
FRANK A. RUSCIANO, chief engineer of the Lithium Co., Newark, N. J., manufacturer of industrial furnaces and gas generators, has been promoted to vice-president and works manager.

J. G. WELLS, JR., has been appointed sales manager of the Lobdell United Co., Wilmington, Del., manufacturer of machinery for the paper industry and special machinery for other industries, such as grinders, drill slotters, and forging hammers.

New York

WILLIAM M. BLACK and JOSEPH L. MULLIN have been appointed president and vice-president, respectively, of Electro-Alloys Division, American Brake Shoe Co., New York City. WALTER G. HOFFMAN, formerly president of this division, was made assistant to the vice-president for research and development.





(Left) Robert A. Bower, assistant to executive vice-president of the Doehler-Jarvis Corporation. (Right) Mark F. Beckington, assistant general purchasing agent

ROBERT A. BOWER, formerly assistant general purchasing agent, has been appointed assistant to the executive vice-president of the Doehler-Jarvis Corporation, New York City, manufacturer of die-castings. MARK F. BECKINGTON succeeds Mr. Bower as assistant general purchasing agent.

HOMER L. LACOCK has been made district field engineer in the northern New York territory for the Dayton Rogers Mfg. Co., Minneapolis 7, Minn. His headquarters are at 905 South Ave., Rochester 20, N. Y.

CARL HIRSCHMANN CO., Manhasset, N. Y., has been made U. S. representative for TECHNICA A. G., GRENCHEN, Switzerland, manufacturer of milling machines and accessories for precision work on small parts.

JOSEPH T. MCNALLY has been appointed sales agent in the New York district sales office of the American Car and Foundry Co., New York City, Mr. McNally will specialize in tank car and miscellaneous sales.

AUSTIN INDUSTRIAL CORPORATION, 50 Church St., New York 7, N. Y., has been appointed exclusive United States and Canadian distributor for Sajo horizontal milling machines, which are manufactured in Sweden.

LOUIS P. SMITH has been made manager of the Ithaca plant of the Morse Chain Co., Detroit, Mich., a subsidiary of the Borg-Warner Corporation.

Ohio

KARL H. MEYER has become manager of the Ivanhoe Division of the Reliance Electric & Engineering Co., Cleveland, Ohio. Prior to his promotion, he had been manager of the Ashtabula, Ohio, plant. WALTER H. HABER, who was production manager of the Ashtabula plant, has been made manager, in Mr. Meyer's place.

LEO A. LEGAT has been appointed sales representative in northern Ohio and western Pennsylvania for the Billings & Spencer Co., Hartford, Conn., manufacturer of drop-forged wrenches, shop tools, and industrial forgings. Mr. Legat's headquarters are at Parma, Ohio.

AUTOMATIC STEEL PRODUCTS, INC., Canton, Ohio, announce that the company has acquired the Metroloy Corporation of New Rochelle, N. Y., maker of cold-formed steel products. LEO EDELSON, president of the Metroloy concern, will continue in that capacity.

B. W. WILD has been appointed assistant works manager for the Columbia Machinery & Engineering Corporation, Hamilton, Ohio. Before joining the corporation, Mr. Wild was master mechanic with the Bendix Aviation Corporation.

GEORGE P. LONG has recently joined the Cleveland Chain & Mfg. Co., Cleveland, Ohio, as assistant general sales manager. WILLIAM W. FULLER has been appointed purchasing agent. Mr. Long has had more than four years of experience in the chain industry, most recently in a sales administrative capacity.

JOHN S. MADDEN has been appointed sales manager of the G. A. Gray Co., Cincinnati, Ohio, manufacturer of planers and boring machines. Mr. Madden has a broad background of sales and electrical engineering experience.

Pennsylvania and West Virginia

BRENHOLTS, GOIN & OGG, INC., has been incorporated as a management consulting organization, with offices at 201 E. Carson St., Pittsburgh 19, Pa. Officers of the new company are: President, HOWARD F. BRENHOLTS; and vice-presidents, NEWBOLD C. GOIN and ERSON V. OGG. Mr. Brenholts is a Pittsburgh industrialist; Mr. Goin was executive secretary of the American Gear Manufacturers Association for ten years; and Mr. Ogg was director of industrial engineering with the Chase Brass & Copper Co.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., recently presented four employes with the Allegheny Ludlum Award. The awards, consisting of a citation, the "President's Medal," and $1000, were presented to SCHUYLER A. HERRES, associate director of research with headquarters at the Watervliet, N. Y., plant; DOUGLAS S. GORMLY, assistant chief metallurgist at the Dunkirk, N. Y., plant; and I. G. SHOFF and JOHN EAGLESON, manager and assistant manager of the hot mill department in the West Leechburg, Pa., plant.

PITTSBURGH PLATE GLASS CO., Pittsburgh, Pa., is entering the fiber glass production field, and is forming the Fiber Glass Division for this purpose. J. HERVEY SHERTS will serve as general manager of the new division. Fiber glass is used for both insulation and sound absorption in aircraft and automotive applications, as well as in the electrical industry.

L. E. OSBORNE, formerly vice-president in charge of manufacturing of the Westinghouse Electric Corporation, Pittsburgh, Pa., has been named

Pogue's Studio

John S. Madden, newly appointed sales manager of G. A. Gray Co.

to the newly created post of executive vice-president, defense products. TOM TURNER, vice-president in charge of labor relations, is assuming the manufacturing responsibilities formerly assigned to Mr. Osborne, his new title being vice-president in charge of manufacturing and labor relations.

HARRY W. GORDON and SIDNEY H. HEWETT were recently appointed district managers by the American Pulley Co., Philadelphia, Pa. Mr. Gordon's territory is in the Northwest, extending into British Columbia and Alberta, Canada. His headquarters are at 911 Western Ave., Seattle, Wash. Mr. Hewett is in the Detroit area, his territory including sections of Michigan, Ohio, Indiana, and Kentucky. Mr. Hewett's headquarters are at 1357 Sheridan Ave., Plymouth, Mich.

PRECISION TUBE Co., Philadelphia, Pa., recently announced its entry into the field of precision low-carbon, welded and drawn steel tubing, which can be substituted in many mechanical applications for scarce non-ferrous and alloy metal tubing.

WILLIAM D. ROBERTS was recently appointed vice-president in charge of engineering and research of the Ryman Engineering Co., Ellwood City, Pa., builder of machines on which coated abrasives are used.

HARRIS PUMP & SUPPLY Co., Pittsburgh, Pa., has been appointed distributor for the CLECO DIVISION of the REED ROLLER BIT Co., Houston, Tex., manufacturer of air tools and accessories.

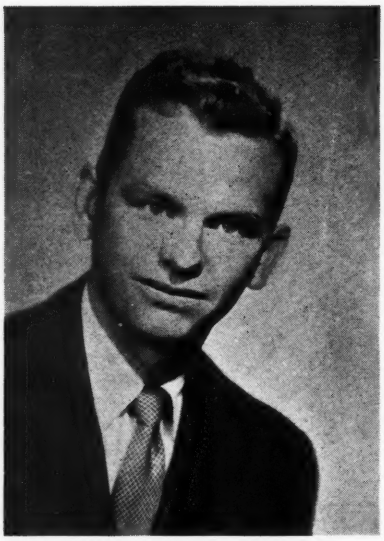
A. BRUCE MAINWARING has been made plant superintendent of Uniform Tubes, Collegeville, Pa., manufacturer of small-diameter seamless tubing and aluminum alloy "pointer" tubing.

BAKER EQUIPMENT ENGINEERING Co., 404 Morris St., Charleston, W. Va., has been appointed representative for the line of materials-handling machinery made by the Yale & Towne Mfg. Co., Philadelphia, Pa.

Wisconsin

R. A. METCALF, assistant sales manager of the Miller Electric Mfg. Co., Appleton, Wis., has been promoted to the position of sales manager. Mr. Metcalf has been associated with the welding industry in various sales capacities during the last fourteen years.

E. H. ROCKS, chief engineer of the Greene Mfg. Co., Racine, Wis., was recently promoted to the position of vice-president. He will continue in charge of engineering.



Roger A. Kenman, sales manager of the Machine Tool Division, Charles H. Besly & Co.

ROGER A. KENMAN has been appointed sales manager of the Machine Tool Division of Charles H. Besly & Co., Beloit, Wis., manufacturer of grinding equipment and abrasive wheels.

Obituaries

LEON R. LUDWIG, director of engineering and research for the Westinghouse Electric Corporation's Atomic Power Division, died in Pittsburgh, Pa., on November 14 at the age of forty-seven years. Mr. Ludwig was graduated from the University of Illinois in 1925, and shortly after joined the Westinghouse Electric Corporation. He had served the corporation in many capacities. Prior to his recent appointment as director of engineering and research of the Atomic Power Division, he was manager of the Buffalo, N. Y., plant.

DANIEL F. ELLIS, master mechanic of Borg & Beck, Division of Borg-Warner Corporation, Chicago, Ill., died on October 6 at his home in Riverside, Ill. Mr. Ellis had been with the company since 1938, serving first as chief tool designer and later as master mechanic. He is survived by his wife and two sons.

ROBERT N. BLAKESLEE, vice-president and director of engineering of the Ajax Electrothermic Corporation, Trenton, N. J., died suddenly on October 17 at the age of fifty-eight years. Mr. Blakeslee was with the corporation for twenty-four years, and became vice-president in 1941.

Coming Events

JANUARY 14-17, 1952—PLANT MAINTENANCE SHOW and PLANT MAINTENANCE CONFERENCE at Convention Hall in Philadelphia, Pa. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York City.

FEBRUARY 9-MARCH 24, 1952 — INTERNATIONAL INDUSTRIAL MACHINERY EXPOSITION in Delhi, India. Further information can be obtained from Consulate General of India, 3 E. 64th St., New York 21, N. Y.

MARCH 11-14, 1952—Fifth NATIONAL PLASTICS EXPOSITION, sponsored by the Society of the Plastics Industry, Inc., to be held at Convention Hall, Philadelphia, Pa. Further information can be obtained from Langdon P. Williams, director of public relations, 67 W. 44th St., New York, N. Y.

MARCH 17-21, 1952—Ninth Biennial Industrial Exposition of the AMERICAN SOCIETY OF TOOL ENGINEERS at the International Amphitheatre, Chicago, Ill. Harry E. Conrad, executive secretary, 10700 Puritan Ave., Detroit 21, Mich.

MARCH 22-APRIL 6, 1952 — Second CHICAGO INTERNATIONAL TRADE FAIR at the Navy Pier, Chicago, Ill. For further information, write to Executive Vice-president John N. Gage, Colonel U. S. A. (Ret.), Merchandise Mart, Chicago 54, Ill.

MAY 1-7, 1952—International Foundry Congress and Show at Convention Hall, Atlantic City, N. J. Sponsored by the AMERICAN FOUNDRYMEN'S SOCIETY, 616 S. Michigan Ave., Chicago 5, Ill.

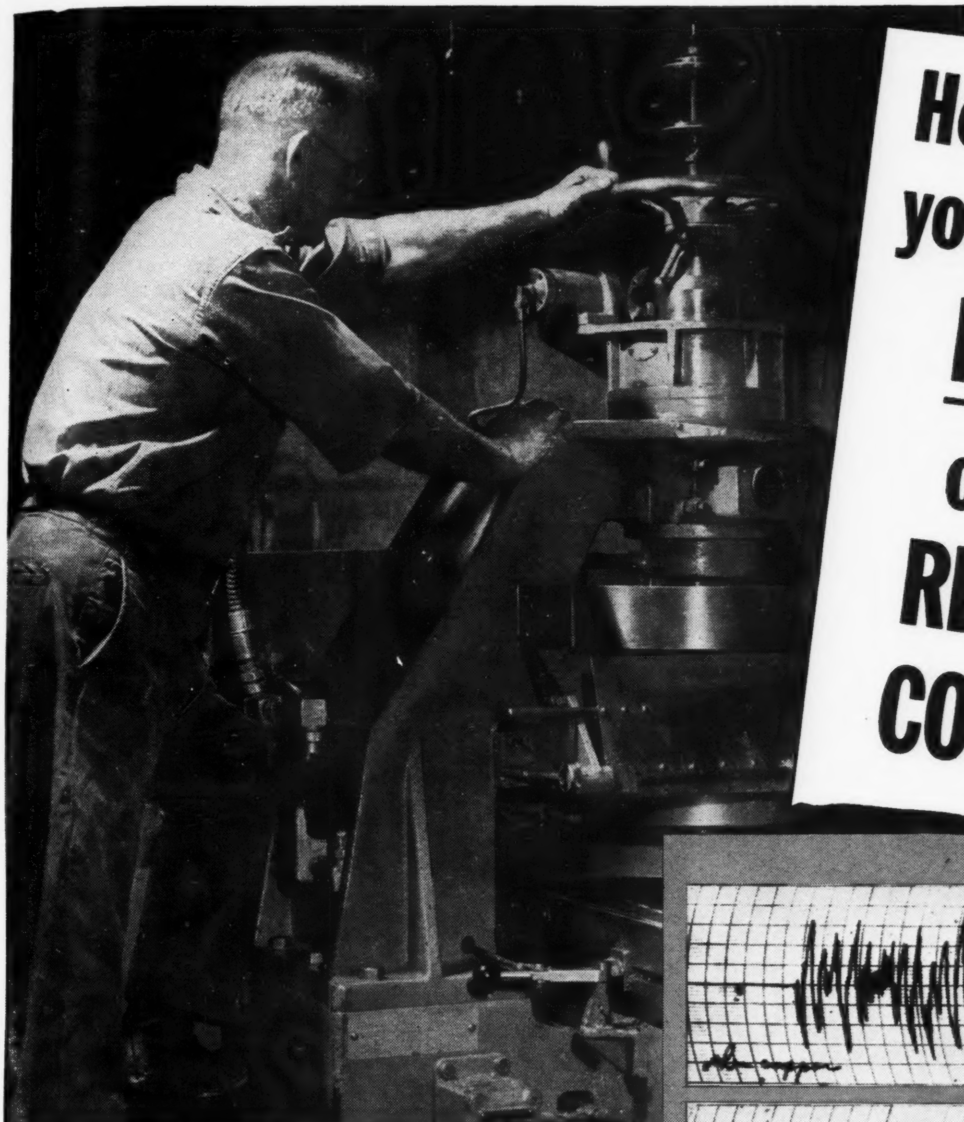
MAY 22-24, 1952—Sixth annual convention of the AMERICAN SOCIETY FOR QUALITY CONTROL at the Onondaga County War Memorial, Syracuse, N. Y. Further information can be obtained from the Society, Room 5036, 70 E. 45th St., New York 17.

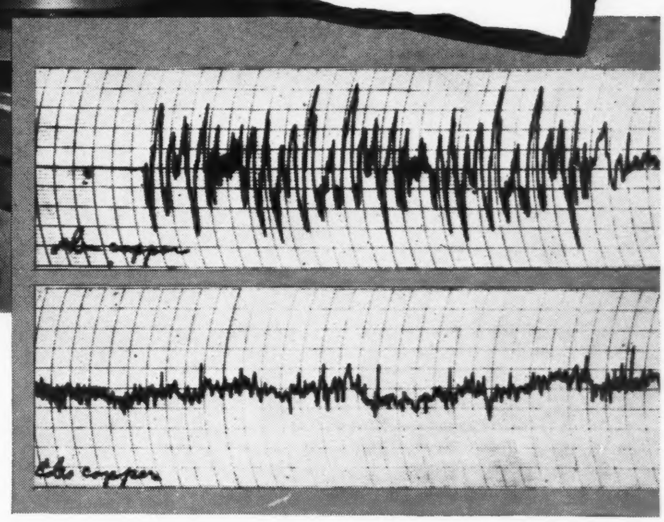
JUNE 23-27, 1952—Fiftieth anniversary meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Hotels Statler and New Yorker in New York City. Executive Secretary, C. L. Warwick, 1916 Race St., Philadelphia 3, Pa.

* * *

The total value of lathes shipped during 1950 amounted to over $79,000,000; grinding and polishing machines, $61,000,000, and milling machines, $36,000,000. These three major types of machine tools accounted for 58 per cent of the value of machine tools shipped in 1950.

Here before your eyes is PROOF of fine REVERE COPPER





Diamond surfacing machine in the Edes plant, producing a perfect surface on a Revere Copper Sheet.

Charts showing typical surfaces. Top, ordinary copper plate. Bottom, a diamond-finished Edes plate. It takes fine copper to produce this result.

• One of the country's best-known suppliers of copper plates for photoengraving is The Edes Manufacturing Company, Plymouth, Mass. Edes has developed a patented process that is unique for giving plates the final polish. They are surfaced with diamond cutters, specially cut and ground. The plates thus produced and shipped to photoengravers have an accuracy of plus or minus .00025 inch, practically dead flat and true to gauge at any point within these limits. Obviously, only exceptional copper will do.

Making copper sheets for this service is an exacting process. The metal as supplied by Revere must be specially handled in the mill to make sure there are neither surface nor imbedded imperfections, since a pin-point defect in the finished plate will show in printing.

Revere has always taken a deep interest in the graphic arts, not only because the industry is a good market for copper, but also because Paul Revere himself was a skilled engraver on copper. Thus it is likely that the original plates for this advertisement were of Revere Copper, and also many of the plates used by the magazines you read. In addition, Revere supplies copper rolls for rotogravure, the comics, and for textile printing. For fine copper for graphic processes, consult Revere.

REVERE 150th YEAR OF SERVICE TO AMERICA

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere

SEE "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

New Books and Publications

MATERIALS HANDBOOK. By George S. Brady. 913 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $8.50.

Information on approximately nine thousand materials is given in the new seventh edition of this handbook. The book has been expanded to include almost fifteen hundred more materials than were contained in the previous edition. It now supplies a wealth of facts and figures to simplify estimating, specifying, and purchasing in product manufacturing and processing.

Part 1 of the book gives the physical and chemical properties of the materials; describes substitute and alternate materials; and includes numerous examples of how the materials are used. These basic data on both the natural and synthetic materials used by industry (such as compounds, abrasives, alloys, metals, minerals, woods, fibers, ores, pigments, solvents, plastics, etc.) are presented in readily understandable language. Patented and trade-named materials are included.

Part 2 contains charts, maps, and tables on the world distribution and production of the materials of industry, accompanied by interpretations and analyses. It is designed to provide economic and geographic information essential for intelligent and effective planning for the use of materials.

This reference source is designed to aid management officials, engineers, and purchasing agents in choosing the right material for any specific purpose. Users of the volume who are not technical specialists can obtain a knowledge of the relative strengths, hardnesses, weights, etc., that will save valuable time in judging new materials that come to their attention.

THEORY OF PERFECTLY PLASTIC SOLIDS. By William Prager and Philip G. Hodge, Jr. 264 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $5.50.

This book is not an exhaustive treatise on the general theory of plasticity, but is intended to serve as an introduction to the particular branch known as the theory of perfectly plastic solids. It is the first book dealing with this subject to be written in English on an intermediate level. Numerous findings of practical importance to the designer in this field, including recent results in limit analysis, are now available and are presented here.

The material is based on a survey report made by one of the authors for the Office of Naval Research. While this report was intended primarily for research workers, the material has been transformed to serve equally well as a text-book for students of engineering or applied mathematics. The mathematical background required of the reader is that necessary for studying the advanced strength of materials or elementary theory of elasticity.

The treatment covers the mechanical behavior of trusses and beams under strain or stress; torsion of cylindrical or prismatic bars; and plane strains. At the end of each section, problems are included to enable the student to make practical application of the principles set forth.

A TREATISE ON MILLING AND MILLING MACHINES. 910 pages, 6 1/4 by 9 1/4 inches; over 700 illustrations and charts. Published by the Cincinnati Milling Machine Co., Technical and Service Publications Department, Cincinnati 9, Ohio. Price, $8.

A comprehensive treatment covering the theory and practice of metal cutting by the milling processes and such related subjects as tool-room milling set-ups, fixture design, etc., is presented in this book, which is now in its third edition. The text covers the function and operation of a variety of milling machines and milling attachments; milling cutters—types, uses, care, etc.; technical data on metal cutting, including power required for milling, feeds, speeds, rate of stock removal, and milling time; examples of the most advanced production methods; selection of milling machine equipment; and estimating for production milling. Numerous examples illustrate the use of milling machine equipment on production, tool-room, and die-sinking work.

This book, which is based on the company's sixty-seven years of experience in building precision milling and cutter sharpening machines, should prove an invaluable text and reference book for engineers and machine operators, as well as teachers and students.

FUNDAMENTALS OF SUPERVISION. By Charles F. Harad. 224 pages, 8 by 10 1/2 inches. Published by Delmar Publishers, Inc., Orange St. and Broadway. Albany 7, N. Y. Price, $3.75.

A course dealing with the fundamentals of supervision, written specifically for the supervisor or foreman, is presented in this book. The problems discussed are those encountered by supervisors every day in the week. The text contains units of instruction, which include objectives, discussion, and assignments. There are twenty-eight units, including a final review of the entire course.

The contents are divided into three main sections — "The Supervisor Learns About His Company"; "The Supervisor Learns About Himself"; and, "The Supervisor Learns About His Fellow Workers." Such problems as getting increased production, reducing waste, handling grievances, absenteeism, developing initiative are a few of the many dealt with.

The training program includes a separate book entitled "Conference Leader's Guide." The cost of this supplementary book is $2 additional. It gives detailed methods and procedures for the successful presentation of each unit of the text, comprising such points as how to stimulate discussion; how to emphasize and summarize main points; and how to question or review the knowledge of a student.

RECOMMENDED PRACTICE FOR THE WELDING OF STEEL CASTINGS. 40 pages. Published by Steel Founders' Society of America, 920 Midland Bldg., Cleveland 15, Ohio. Price, 35 cents.

This report is based on comprehensive studies carried out by the Steel Founders' Society, member companies, and professional research engineers. It comprises a guide for use in establishing reliable procedures in welding steel castings, equally adaptable to the needs and problems of the fabricator and of the foundry.

SERVOMECHANISMS AND REGULATING SYSTEM DESIGN. By Harold Chestnut and Robert W. Mayer. 505 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $7.75.

This book is one of a series written in the interest of the advanced course in engineering of the General Electric Co. It is the first volume of a work dealing with servomechanisms and regulating system design. The material presented had its origin in the experience of the company in designing control systems and regulators for the armed services and for industry.

The first volume of this work is adapted to the needs of engineering students and engineers who have not had previous training or experience in the field of closed-loop control systems. The book starts from basic mathematics, describes the nature of the physical problems involved, and proceeds to the solution of advanced designs. It emphasizes the feed-back control concept for regulators and servomechanisms.

Many typical systems are illus-

trated, and information is given on mechanical, electrical, hydraulic, and steering system transfer functions. Charts indicating the nature of design characteristics necessary for steady-state and transient operation are included. A large number of problems illustrating the principles are presented.

* * *

Rapid, Accurate Method of Determining Fatigue Limit

Two scientists at Rensselaer Polytechnic Institute — Dr. Joseph L. Rosenholtz and Professor Dudley T. Smith—have developed a rapid and accurate method of testing steel alloys, other metals, and plastics to determine how long they will stand up under normal loads when used for making moving parts of machines. The inventors call this development the "Dilastrain Method."

It is based on precise measurements of the extent to which specimens of a given material expand under controlled temperatures. The patent rights will be held by Rensselaer Polytechnic Institute, which will make the "Dilastrain Method" available under a licensing plan.

This method involves selecting identical specimens of the material and putting them under stress in a definite range. They are then put through an equal number of cycles of vibration, so that all will be on an even level of fatigue. This takes a few hours.

The specimens are then placed in the apparatus and subjected to controlled temperatures ranging from 20 to 100 degrees C. The test pieces all have the same length—about 2 inches —to start with, but it has been found that as temperatures are stepped up, each specimen changes in length in proportion to the amount of stress to which it has been previously subjected.

The apparatus automatically magnifies the amount of such expansion 3500 times and records it. In approximately two hours, the total linear expansion of all test specimens has been recorded. When these values are plotted against the stresses previously applied, it is found that a sharp dip in the resulting curve appears at the point where the test material reaches its endurance limit.

Machining Fine Graduations in an Alloy Metal Precision Scale

An unusual problem was recently encountered by Theo. Alteneder & Sons, Philadelphia, Pa., in the manufacture of drafting instruments. A government contract called for special 12-inch scales, engine-divided into graduations of 0.01 inch. The company had made similar scales using a variety of materials, but in all previous cases, only the first inch had to be marked off in 0.01 inch graduations. Twelve full inches to be so divided created a manufacturing problem.

Stainless steel, desirable because of its durability, caused considerable difficulty in trial runs, not only during machining the basic strip, but also in cutting the 1201 channels (or grooves) required. Each cut is about 0.005 inch deep, and one groove is required at each graduation. The life of the tiny special-alloy cutting tool, which makes an in and out trip through the stock to produce the groove, was very short.

Softer materials, such as brass, aluminum, or plastic, were easier to work, but were not durable; moreover, it was found that grooves cut in aluminum were somewhat more difficult to clean. A small burr occasionally remained at the end of the cut or along the sides. This resulted in an irregular groove and hindered the next step, which involves implanting a small quantity of black pigment in the grooves to make the scale easier to read.

Finally, a free-cutting 18 per cent nickel-silver alloy containing 65 per cent copper, 18 per cent nickel, 16 per cent zinc, and 1 per cent lead was tried, with satisfactory results. The lead additive gives the material a relative machineability rating of 50, which compares with a rating of 20 for the alloys that do not contain lead, and 100 for free-cutting brass.

This alloy, produced by the Riverside Metal Co., Riverside, N. J., and known as Riverside Mixture No. 5, was advantageous for several reasons. Burrs resulting from the tiny, closely spaced cuts either break clean or are easily removed, using No. 1 emery cloth. Further, this nickel alloy has a desirable light color, a low coefficient of linear expansion (0.0000090 per degree F.), and good durability—all factors of importance in the mapping and survey work for which the scale is used.

* * *

A record 8,003,045 motor vehicles (passenger cars, motor trucks, and buses) were produced in United States plants during 1950.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (TITLE 39, UNITED STATES CODE, SECTION 233).
of MACHINERY, published monthly at New York, N. Y., for Octobar 1, 1951.

1. The names and addresses of the publisher, editors, managing editor, and business managers are: Publisher, The Industrial Press, 148 Lafayette St., New York 13, N. Y.; Editor, Charles O. Herb; Consulting Editors, Erik Oberg, and Franklin D. Jones; Business Managers, Robert B. Luchars, Edgar A. Becker, and Harold L. Gray. The address of all the foregoing is 148 Lafayette St., New York 13, N. Y.

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EDGAR A. BECKER, Business Manager

Sworn to and subscribed before me this 28th day of September, 1951

(SEAL)

CHARLES P. ABEL
Notary Public, State of New York
No. 24-0002700
Qual. in Kings Co. Certs. filed with
N. Y. Co. Clerk, Kings & N. Y. Co. Registers
Term expires March 30, 1953

Keeping Stainless Steel Clean

STAINLESS steel is extremely tough, corrosion-resistant, and easy to clean, but it can be ruined by misuse. Today, when stainless steel, like most other materials, is hard to obtain, it becomes urgent to do the things that will insure long life. Cleanliness is the key to making stainless steel last a long time, and it is not difficult to achieve. Simple procedures have been worked out to take advantage of the easy cleanability of this material under industrial and process plant conditions. These procedures are widely used, and their effectiveness has been proved by many years of successful application.

All users of stainless steel may do well to review their maintenance and cleaning routines in the light of today's shortages. A check-up now can prevent needless damage, and in addition to saving on repairs or replacements, may effect savings by revealing simpler cleaning techniques.

The most important requirement is to clean frequently. At the plants where this problem is handled best, all equipment is cleaned regularly, in accordance with a schedule. Some parts need attention more often than others, and the schedule may be modified from time to time to suit production requirements. Nevertheless, every part should be listed, so that nothing will be overlooked.

The question of how often to clean depends on how rapidly accumulations develop not on the endurance of the stainless steel surface. As soft deposits come off more easily than hard ones, it pays to remove them before they "cake up." Soap and warm water can be used to remove dirt, grease, and ordinary residue. A detergent may be used with soap or the detergent may be sufficient alone. The dissolving action can be hastened by adding soda ash, baking soda, borax, sodium perborate, trisodium phosphate, etc.

The cleaning solution can be applied with a brush, swab, sponge, or cloth. Large areas should be flushed with hot water or steam, and rinsed afterward with clear water. An organic solvent like carbon tetrachloride, acetone, ether, or alcohol may be helpful for substances that are not water soluble.

If any dirt fails to come off by the use of the agents mentioned, mechanical removal may be necessary. The finest abrasive that will do the job should be used. Ordinary steel wool, scouring pads, scrapers, wire brushes, files, or other steel tools should not be employed, since bits of iron left embedded in the stainless steel surface will cause more trouble than any temporary cleaning benefit is worth.

Starting with a paste of magnesium oxide, Bon Ami, finely powdered pumice, or French chalk, in water and ammonia, the steel should be rubbed gently in the direction of the polished "grain" of the metal. (For tougher scale, stainless-steel wool of the finest texture practicable should be used.) Stubborn deposits of organic or mineral materials often yield to a rinse in 10 to 20 per cent nitric acid, followed by flushing with clear water. Nitric acid will not harm stainless steel, but must be kept away from bronze, brass, ordinary steel, and iron.

Many chlorine-bearing compounds used in the food processing industries to insure complete sanitation of equipment may break down and release free chlorine or form hydrochloric acid. Stainless steel resists exposure to such agents for an ample time to permit thorough sanitation. However, they will cause damage if allowed to stand too long in equipment made from stainless steel. To guard against attack or pitting, the sterilizing time should be kept as short as practicable—say, two hours maximum.

All the chemicals should be rinsed out afterward with water, and the equipment should be operated normally between applications. With these precautions, the sterilizing solutions may be used any number of times. Agents that release oxygen, such as sodium perborate or sodium peroxide, have no harmful effects on stainless steel and may be freely used.

Condition of Equipment Affects Cleanliness

Cleanliness depends a great deal on how the plant equipment is designed and set up. Smooth surfaces are the easiest to clean, and work contact areas should be kept polished and bright. Scratches that may catch bits of residue should be avoided, and any gouges that may have occurred accidentally should be thoroughly removed by polishing.

Dirt or product residue accumulates in cracks, crannies, and pockets, and corrosive pitting may occur underneath such deposits if they are allowed to remain. Places where solids accumulate should be avoided whenever practicable. If this is not possible, special steps should be taken to insure regular inspection and removal of such residue. Parts of the equipment, like screens and strainers, that may be hard to clean should be removable. Free access to the equipment should be provided, if possible, as an aid to maintenance. Spilled, splashed, and condensed material should be removed regularly before it hardens.

Places on the equipment where stainless steel is in contact with other materials should be inspected periodically. Neoprene gaskets may be used to prevent electrolytic action between stainless steel and other metals. Such porous materials as wood, fiber, etc., should be sealed off from stainless steel with asphaltum or some equivalent material. Gaskets and packings that contain graphite should be avoided, as they tend to accelerate corrosion of stainless steel.

The processing cycle should be regulated to prevent unnecessary concentrations of solids or pastes containing corrosive agents. Evaporation may result in the concentration of corrosive products in upper layers of exposed moist solids or vapors may condense on hoods or on parts of the equipment not made from stainless steel. Trouble from such effects usually takes a long time to develop, but it is worth while to take preventive measures to forestall it.

If corrosive chemicals are normally handled in solutions containing an inhibitor, careful controls should be set up to insure that the inhibitor is always present in the proper concentration. Stainless-steel vessels for heating liquids should be filled to the normal level before heat is applied. If accidental overheating should cause tinted discoloration of the steel, this is merely evidence that the protective surface film has grown thicker. It need not be removed, but in cases where it is desirable to do so, this can be accomplished by gentle polishing with mild abrasives.